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PROGRESS ON THE ROOSEVELT DAM, SALT RIVER PROJECT, U. S. RECLAMATION SERVICE.

By CHESTER WASON SMITH,* Assoc. M. Am. Soc. C. E.

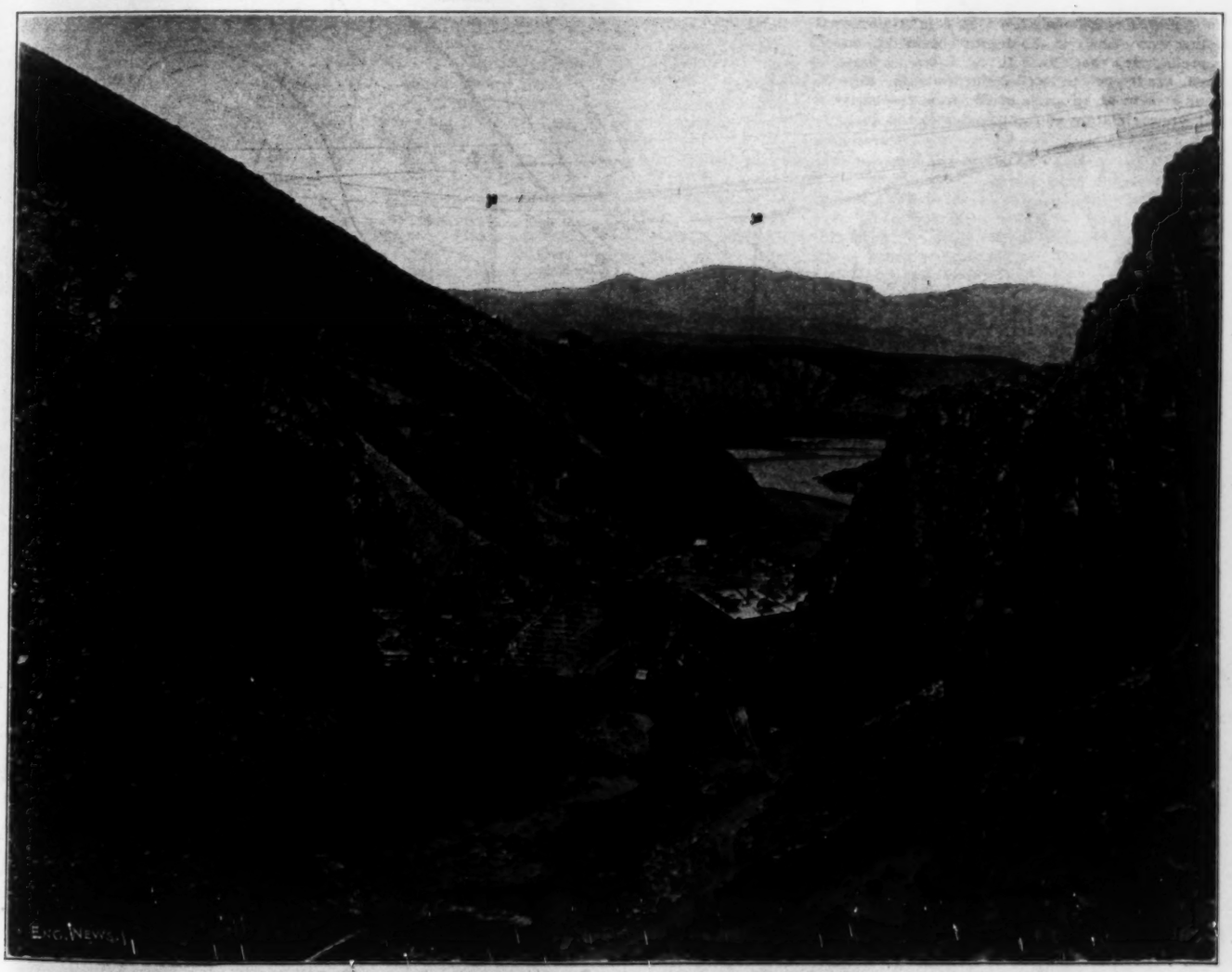
The Roosevelt Dam, which when completed will be one of the highest dams in the world, has been under construction for three years and has now (September, 1908) reached a maximum height of 108 ft. above bed rock. The dam will eventually provide storage for 1,284,000 acre-feet of water for irrigation purposes. It will have a maximum height of 276 ft., or 240 ft. from the natural bed of the stream, and this great height will be attained with a crest length of about 700 ft., not including the two spillways.

The following notes are designed to give a general idea of the progress and nature of the work up to the present time. The first view [on this page] shows the dam as it appeared on July 1, 1908, and is supplemented by Fig. 5, which shows the dam looking down-stream. Figs. 1 and 2 show the vicinity of the dam, including the plant of the contractor, and Figs. 3 and 4 give some idea of the flood conditions encountered from time to time.

The dam as originally proposed, was described and illustrated, and the principal features of the specifications quoted, in Engineering News for Jan. 12, 1905. Bids were received in Phoenix, Ariz., Feb. 23, 1905 (see Eng. News, March 9, 1905, p. 91, Construction News Supplement), and on April 8 a contract was made with John M. O'Rourke & Co., Galveston, Tex., for its construction.

The only change in plan has been to raise the proposed height of the reservoir flow line and dam 10 ft., the cross-section of the dam remaining the same, i. e., at equal distances below the top, the thickness is the same. This change was due to, and warranted by, the large rainfall and runoff figures for 1905.

*Engineer U. S. Reclamation Service, Roosevelt, Ariz.



THE ROOSEVELT DAM ON JULY 1, 1908; LOOKING UPSTREAM.
(The proposed height of the crest of the dam is at the elevation of the road along the cliff at the left.)

The contractors worked through the summer and fall of 1905, establishing camp, getting in plant, stripping the quarries, and driving piles for cofferdams and flume.

By the latter part of November all the piles had been driven, but on Nov. 27 occurred the second largest flood on record for the Salt River. At noon, Nov. 26, it began to rain, and between 6 p. m., Nov. 26, and 11 a. m. of the 27th the river rose about 30 ft. at the dam site; from a discharge of a little over 2,000 sec.-ft. to a maximum of about 130,000 sec.-ft. This destroyed all work done on the cofferdams and flume and washed away some machinery.

Construction could not be resumed on the temporary works till some time in March, and after that some delay and damage was caused by floods. In the meantime, it had been decided, upon the request of the contractors, to dispense with the flume and depend entirely upon the sluicing tunnel to carry the river, which tunnel has a capacity of about 1,300 sec.-ft., with water at the elevation of the top of the cofferdam.

Early in June the cofferdams were completed, and on June 13, 1906, the river was diverted through the tunnel. For the next three months the work was to make the cofferdams tight, and excavate the material between them to bedrock. (See view of dam in flood, Fig. 3.) All the pumping, and much of the excavation, was done by two 11-in. Campbell hydraulic excavators and four small auxiliary hydraulic pumps, all of which were supplied with water from the power canal, with a head of about 240 ft. For handling the water nothing better or cheaper could be devised, but, owing principally to the nature of the material encountered, the excavators were only moderately successful.

The bedrock was encountered at depths corresponding very closely to the depths obtained from the preliminary borings. It is a hard, fine-grained sandstone, in well-defined strata, dipping up-stream at an angle of 29° from the horizontal, approximately at right angles to the dam, which is the most favorable position possible. A few small mud seams and faults occurred, but nothing presenting any special problem.

The first stone was laid Sept. 20, 1906, and progress on the masonry was regular till the winter floods, which began Dec. 2.

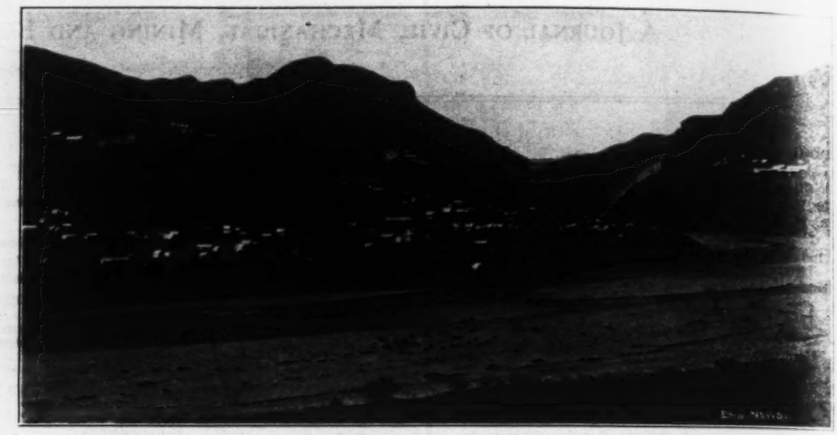


FIG. 2. GENERAL VIEW OF VICINITY OF ROOSEVELT DAM, ARIZONA.

(Roosevelt and Salt River on the opposite river bank. In background, from left to right: U. S. Reclamation Service headquarters, cement mill, dam site, and, across river, the camp of J. M. O'Rourke & Co., Contractors for the dam.)

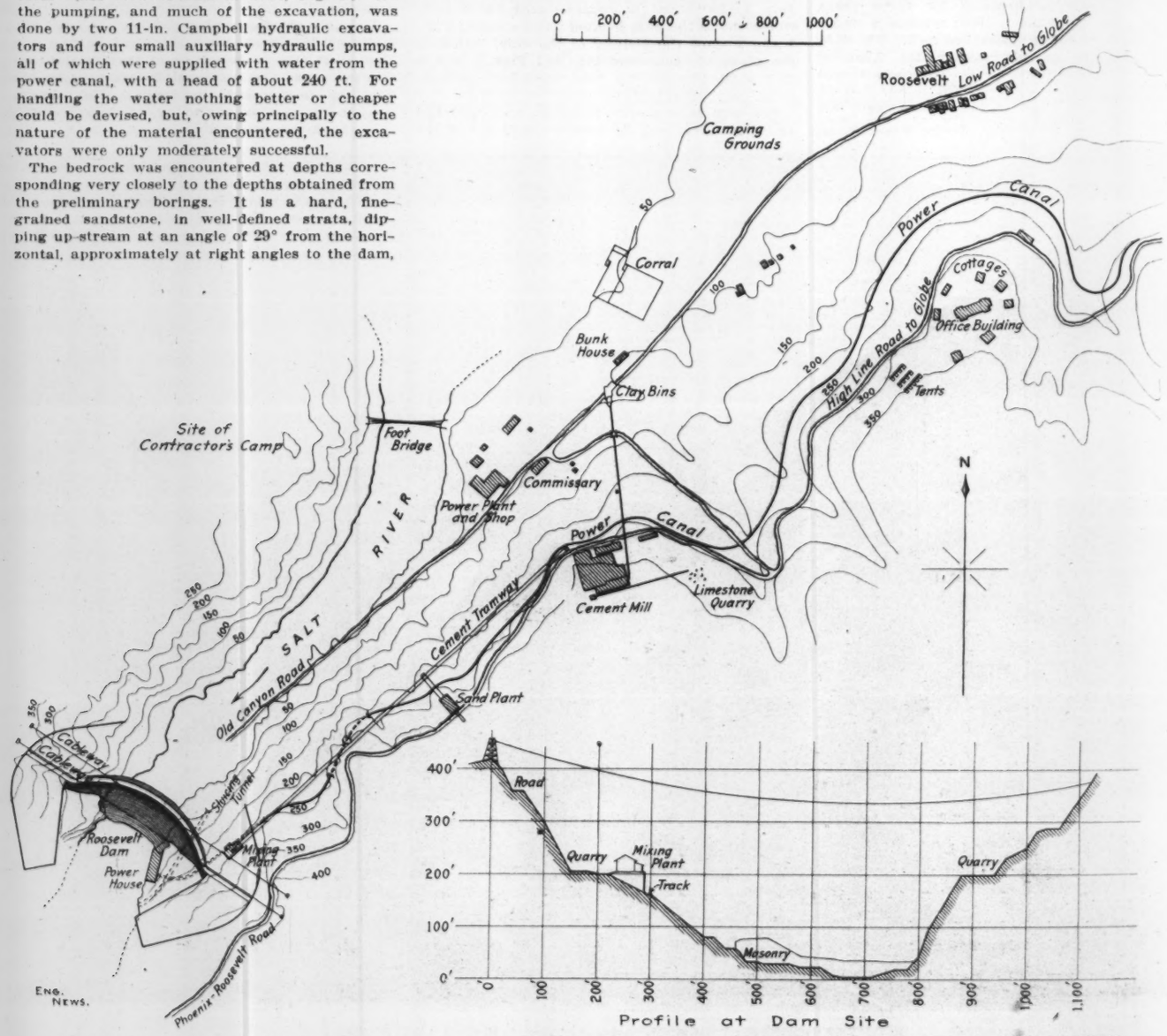


FIG. 1. MAP OF ROOSEVELT DAM AND VICINITY, SHOWING GENERAL LAY-OUT OF CONTRACTOR'S CAMP; ALSO PROFILE OF DAM.

FIG. 4. ROOSEVELT DAM CONSTRUCTION IN FLOOD, FEB. 4, 1908, LOOKING DOWN-STREAM.

In the spring of 1907 the cofferdams had to be entirely rebuilt, the upper one being constructed this time of masonry, and it was the middle of June before the pit was again cleaned out and work on masonry resumed. During the summer and fall of 1907 many small but vexatious delays were due to floods just above the capacity of the sluicing tunnel; but during November and December, 1907, and January, 1908, there were no floods, and excellent progress was made; so that, when high water did come, on Feb. 4, the south two-thirds of the dam was at Elev. 25, and the north one-third at Elev. 9 (the latter left in that way for a channel for the river over the north end). On arriving at this stage, it might have been said that danger of serious interference or damage from floods was past, and that there was no further use for cofferdams.

At about this time the sluicing tunnel was closed by bulkheads at the entrance, in order that the gates could be put in. These gates were fully described in Engineering News for May 30, 1907. They were erected, and the accompanying reinforcement and concrete was put in to such a point that, on June 2, 1908, the tunnel was again used to carry the river.

During February to June, 1908, masonry was laid on the south end of the dam, bringing it up to Elev. 75, and since June 2 masonry has been laid on the north end of the dam, which is now at Elev. 40.

The principal features of the contractors' plant are as follows (see plan and profile, Fig. 1):

Two Lidgerwood cableways, 1,200 ft. long, span the canyon at an elevation of about 350 ft. above the river. During the day shift they bring down the mortar and concrete, which are mixed on the south hillside, and spalls from the quarry at the north end of the dam. During the night shift no masonry is laid, but the cableways bring down stone and spalls, storing them on the dam.

A smaller cableway disposes of the waste from the quarry, and another brings in a small amount of stone from a quarry on the north side of the river, 600 or 700 ft. above the dam.

In the quarry at the south end of the dam is the crushing and mixing plant, consisting of a No. 7½ Style D Gates crusher, elevator, bins, 1½ cu. yd. Smith mixer, etc. The mixing plant is the terminal of a Leschen tramway about 1,700 ft. long, which brings cement from the cement mill and sand from the sand-crushing plant; the cement mill and the sand-crushing plant being operated by the Reclamation Service.

During July, 1908, the mixer delivered an average of 212 batches per eight-hour shift; two batches per skip-load, which was run out on a track to a point under the cables.

About fifteen derricks are used for quarries and masonry, equipped with swinging-gear, and operated principally by electric engines of about 40-HP. capacity.

At a central power station is a motor generator set for transforming the 2,200-volt alternating current delivered by the Government to 500-volt direct current used by the various motors; also an air-compressor with a capacity of 700 cu. ft. of free air per min. to 100 lbs. pressure.

Several operations of the Reclamation Service are intimately connected with the work on the dam, as follows:

Power is furnished to contractors at ½ ct. per HP.-hr. For this purpose a power canal, 19 miles long, capacity 250 cu. ft. per sec., was built. This gives a drop of 220 ft. at the dam site. At the intake of the canal is a concrete diversion dam, 450 ft. long, which raises the water about 6 ft., headgates, sluicegates, etc. On the line of the canal are 21 tunnels, 75 to 1,700 ft. long, through all kinds of ground, and all concrete-lined; also sluice gates, overflow weirs and other structures. Some inverted siphons of reinforced concrete, on this canal line, were described in Proceedings of the American Society of Civil Engineers for August, 1907. About a mile and a half of the open canal was also lined with concrete. The canal was put in operation about April 1, 1906, and, with but slight interruptions, has furnished power ever since.

The last tunnel on the line is the penstock tunnel, circular in section, 7 ft. in diameter, passing under the south spillway at the dam site and on to the power-house, just below the dam.

The first hydro-electric unit of 1,000 KW. was placed in a small cave excavated in the face of the cliff behind the power-house proper. The power-house has been built since, and other units are being installed.

A cement mill, with a nominal capacity of 300 bbls., but with an actual capacity of over 400 bbls. per 24 hrs., was built, and has been in operation since the spring of 1905. This mill has furnished the larger part of the cement used in the canal and appurtenances; practically all the cement used in the Granite Reef diversion dam, 40 miles down-stream on the same project; and all the cement used in the Roosevelt Dam, power-house, etc. It is of excellent quality. The limestone is within 200 ft. of the mill; the clay is hauled about 1½ miles.

Crude oil is used for fuel. This is hauled in tank wagons, 60 miles, from Mesa, and delivered at a contract price of $3.48 per bbl. of 42 gals. A barrel of oil will burn a trifle over 4 bbls. of cement. There is storage capacity for 12,500 bbls. of cement and about 4,000 bbls. of clinker. Owing to the intermittent demand for cement, the mill has been closed down some of the time, and so far has run but a small part of the time

FIG. 5. ROOSEVELT DAM, LOOKING DOWN-STREAM, JUNE 30, 1908.

at full capacity. The cement is delivered at the eastern terminal of the tramway, above mentioned, which is at the cement mill.

To furnish sand for the mortar and concrete used in the dam, the Government built a plant for crushing rock. This is located between the cement mill and the dam, and consists of a Blake jaw crusher, two sets of crushing rolls 36 ins. in diameter, elevator, screen, bins, etc. Later, another crusher, Gates No. 4, was added.

The rock first used was a dolomite limestone. Afterward, in order to get a larger per cent. of fine sand, a rather coarse, soft sandstone was mixed with the dolomite, in equal proportions. The sand is delivered to the same tramway.

The assembling of the materials on the dam has been described. For laying the masonry, stiff-leg derricks are used, with about eleven men per derrick. The larger stones are bedded in mortar, and the vertical joints filled with concrete, which is used quite wet, and into which spalls are rammed. For the narrower or deeper joints the concrete is shoveled in, but a considerable proportion of it is dumped from the skip, and then churned with shovels and bars. An inspector is located at each derrick.

To Aug. 1, 1908, 111,549 cu. yds. of masonry were laid: cement used, 0.71 bbl. per cu. yd. of masonry.

At first, while working in a rather cramped location in the bottom, only 6 to 10 cu. yds. were laid per derrick hour; but since Nov. 1, 1907, 86,629 cu. yds. have been laid in 5,243 derrick hours, or 16.5 cu. yds. per derrick hour.

The masonry is composed of the following:

	Per cent.
1—2 mortar	4.9
1—2½ mortar	11.1
1—2½-4 concrete	32.7
Spalls	9.3
Large stone	42.0

The accompanying tabular analysis of *labor* cost (to the contractors) of the masonry for the month of March, 1908, may be of interest. During the month, 12,000 cu. yds. of masonry were laid.

The operations conducted by the Reclamation Service, largely preliminary to the work on the dam proper, consisted of building about 146 miles of road; erecting a sawmill; sawing about three million feet of lumber and hauling it 30 to 35 miles to Roosevelt; manufacture of bricks, concrete and lime; building telephone lines, erecting and equipping machine, blacksmith and carpenter shops, refrigerating plant, power-house, domestic water supply, electric lighting,

ANALYSIS OF LABOR COST, ROOSEVELT DAM, MARCH, 1908.

	Cost—Total.	Cost—Per cu. yd.
Cement tramway, 1,700 ft. long. Takes cement and sand to mixer. Worked two 8-hr. shifts per day, and took over 8,958 buckets of sand at 8 cu. ft. and 5,626 buckets of cement at 7 cu. ft.:		
Day, 5 men, 27½ shifts	$437.00	
Night, 6 men, 25 shifts	472.00	
Two Lidgerwood cableways, 2¼ in. diameter, 1,200 ft. long. Took from mixer to dam 2,117 skips of mortar and concrete; and from quarries to dam took 630 skips of spalls:		
Day, 8 men, 26½ shifts	688.00	
Night crew takes down stone (almost entirely from quarries on north side of river). Includes collecting stone in quarry, transporting to dam, and some passing around on dam. Took on to dam 5,400 cu. yds. stone and some spalls:		
Night shift, aver. 30 men, 29 shifts.	2,829.00	
Transporting materials, cost	$4,426.00	$0.369
Quarries on north side of river produced 4,800 cu. yds. large stone, 1,134 cu. yds. spalls, 2,170 cu. yds. waste, 234 cu. yds. crusher rock:		
Day shift, aver. 52 men, 29½ shifts.	$4,155.00	
Night shift, aver. 21 men, 29 shifts.	1,677.00	
Quarry on south side produced 334 cu. yds. large stone, 1,442 cu. yds. stone for crusher. Includes also feeding the crusher:		
One shift per day, average 20 men, 28½ shifts	1,612.00	
The 7,944 cu. yds. for the dam, and the 2,170 cu. yds. wasted, cost $7.444 or, say, $0.74 per cu. yd. excavated	7,444.00	$0.620
Stone for up-stream face: This month it was nearly all taken from storage. Used about 200 cu. yds. It would cost about $6 per cu. yd. of cut stone	1,200.00	0.100
Mixing mortar and concrete: Materials drawn from bins into car, transferred 10 ft., and dumped into a 40-cu. ft. capacity Smith mixer, dumped into a skip on a car, and hauled by a stationary engine either 50 ft. to No. 1 cableway or 125 ft. to No. 2 cableway. Mixed 4,234 batches:		
One shift per day, 6 men, 26¼ shifts	517.00	0.043
Cost per cu. yd. mixed, $0.099.		
Laying masonry: Three derricks, 676 hrs. derrick, laid 12,000 cu. yds. = 17.7 cu. yds. per derrick hr. For 6 shifts one gang was split, and with an extra engineer and tagman ran another derrick. Average force per derrick: 1 foreman, 1 engineer, 2 tagmen, 2 masons, 5½ laborers:		
26½ shifts cost	3,506.00	0.291
Miscellaneous:	Men days.	
Moving derricks and cleaning up underneath	46	
Moving derricks from, and back to the wall on account of an anticipated flood	31	
Repairs chargeable to masonry	85	
General expense, includes superintendent, mechanic, electrician, timekeeper, man at power-house, etc.	225	
Total	387	$1,478.00 0.123
Power, 144,236 HP. hrs. from Government	721.18	0.060
Total		$1.606

The above includes all labor, ordinary repairs for the month, and power; does not include any portion of equipment and erection cost, nor any material and supplies.

FIG. 3. ROOSEVELT DAM CONSTRUCTION IN FLOOD, JUNE 16, 1906, LOOKING DOWN STREAM.

etc.; building 19 miles of power canal, with intake dam and other appurtenances; construction of office and camp buildings; the haul of enormous quantities of freight from Mesa and Globe, etc., etc.

Owing to the nature of the country, and distance from base of supplies, not one of these operations could be begun upon the scale which it was necessary to reach later; they were so interdependent that each had to be started when it could, and all carefully nursed and pushed (often by the use of temporary expedients) till they were going properly, i. e., a little progress in one direction enabled something else to be started, or a little better rate of progress made on a third thing, and so on back and forth through the bunch.

The contractors for the dam deserve credit for their persistence through more than two years of discouraging conditions. It is cheerful to be able to record that their troubles are practically over.

The construction of the dam is under the direction of Mr. L. C. Hill, Supervising Engineer, U. S. Reclamation Service, Phoenix, Ariz., with the writer in immediate charge.

THE PRODUCTION OF REFINED LEAD in the United States in 1907, according to C. E. Siebenthal of the U. S. Geological Survey, reached a total of 414,189 short tons, of which 314,241 tons was desilverized lead and 99,948 tons was soft lead. No lead ores from the United States were treated in foreign smelters in 1907. The increase over 1906 was 9,250 tons.

THE PERFORMANCE OF THE NEW STEAMERS "MAURETANIA" AND "LUSITANIA"

Great interest is attached to the performance of the noted steamers "Mauretania" and "Lusitania" of the Cunard Line, owing to their great size and the enormous power of their propelling machinery. The details of the performance, however, have been kept private, and little information has been published except the speed records, which we have noted from time to time. In June, 1908, the "London Times" published in its engineering supplement a very interesting article on the sea performance of the steamers. This was written by Sir William H. White, Past President of the British Institution of Civil Engineers, who was consulting naval architect for the "Mauretania."

A great part of this article relates to the average and maximum speeds attained, to the engine performance, the vibration and the behavior of the ships in heavy seas were also discussed, giving the results of personal observations made in voyages on both steamers.

It may be noted that these steamers are 785 ft. long, with a displacement of about 38,000 tons at mean draft. Each has four screws driven by steam turbines having an aggregate rating of 66,000-HP. This machinery is designed for an average sea speed of 25 knots. The steamers were described in our issues of Aug. 23 and Sept. 27, 1906; and the question of the relation of power to speed was discussed in our issue of Sept. 19, 1907.

We quote from the article already named, as follows:

> The best information available in regard to coal consumption is that contained in a paper read by Mr. Bell before the Institution of Naval Architects in April, 1908. On the third westward passage of the "Lusitania," when 2,176 knots were covered at a mean speed of 24.65 knots, the average shaft-HP. of the turbines was 65,000 HP., and the daily coal consumption for main and auxiliary engines was 1,090 tons. Mr. Bell estimates that nearly 14.6% of the total steam consumption on this voyage was expended for auxiliary services (heating, lighting, ventilating, etc.), and that 13.1 lbs. of coal per shaft-HP. was the average expenditure for the main turbines. This is a very fine performance. On the 1,200 miles contract trial at 25.4 knots, when the shaft-HP. was about 69,000 HP., the average consumption of steam was about 12.8 lbs. per shaft-HP., corresponding to a coal consumption of 1.43 lbs. per HP.-hour.
>
> It will be recognized that the foregoing figures for power differ from those usually given for reciprocating engines, where indicated horse-power is the measure employed and the internal waste-work of the engine must be deducted in order to obtain the shaft-HP. and to make a fair comparison with steam turbines. According to the best authorities the shaft-HP. in large marine engines of the reciprocating type is about 90 to 93% of the I. HP. So that if reciprocating engines had been fitted the power required would have been about 70,000 I. HP. for 24.65 knots.

Economic[illegible] the steam turbines have been proved to be in the [illegible] Cunard steamships, the enormous power required to [illegible] them at the high speed desired involves great coal [illegible]nditure. Mr. Bell gives 5,400 tons as the total [illegible] of coal burned on the voyage in question from [illegible]ool to New York, and 1,090 tons had to be transfe[illegible]rom bunkers to furnaces every 24 hours when run[illegible] at 24.65 knots. All possible means for minimizing [illegible]r in coal-trimming and stoking were embodied [illegible]e design of these vessels, but the task remains a [illegible]y one, and the efficient working of the boilers an[illegible]nomical combustion of the coal necessitates mos[illegible]ful organization and supervision.

When it [illegible]nsidered that the power developed exceeds by more [illegible]0% that of the largest and swiftest Atlantic ste[illegible] previously built, and that the 25 boilers occupy a [illegible]h of about 350 ft., being placed in four separate [illegible]partments, it will be understood that the task is no [illegible]y one and calls for special qualities and experien[illegible] the part of those charged with its supervision.

Here is a case where oil fuel would have been of the greatest value had regular and adequate supplies been available at prices which could be accepted by the Cunard Co. This matter was thoroughly considered in the stage of design. It was recognized that there would be a considerable gain in weight and space required for fuel, large economies of labor in the stokehold and the numbers in its staff, easier regulation of the steam, and more uniform production, as well as considerable advantages in shipping fresh supplies of fuel in port. Guarantees of regular supplies at acceptable prices could not be obtained, however, and the use of coal was decided upon.

Much has been said and written in regard to the vibration of these great ships. The writer has been acquainted with the facts throughout, and as consulting naval architect for the "Mauretania" has been personally interested in the question. He has made thorough investigations of the phenomena of vibration. He is familiar also with the vibratory phenomena of other fast Atlantic steamships, and is in possession of accurate measurements of the actual vibrations in many high-powered steamships. As the result of a careful study of all this information he is decidedly of opinion that (1) in both the "Lusitania" and "Mauretania" the vibration is in no place serious or objectionable; (2) that it is only sensible over narrow limits of length in a few portions of the ships; (3) that even in these places it is so small as to be practically negligible, and (4) that for the most part throughout the ships there is no sensible movement except when speed is being altered or course changed.

The writer can testify to the fact that the sensible vibration is much less than that in many of the preceding Atlantic steamships, and this opinion is confirmed by the comparison of actual measurements of the vibratory movements in a number of ships. At first there were local vibrations of an objectionable character, especially in the after-part abreast the wing propellers. It was also true that the architectural treatment of the great public rooms placed high above water, and in a part of the structure which was not intended to contribute to the main structural strength of the vessels, imposed difficulties of a special nature in keeping down vibrations of the floors and fittings. These difficulties have been overcome by simple additions, largely in the form of girders and pillars, and there remains no reason for serious complaint.

No doubt there are many passengers whose nervous systems are highly-strung who will still experience discomfort. But it is inevitable that when something like 70,000 HP. is being developed and a great ship driven across the Atlantic at a speed exceeding that of many railway trains, absolute quietude cannot be secured. Quiet is not expected on a railway journey, where the shaking is accepted as inevitable. It is true, no doubt, that in a large steamer of the intermediate type, with engines developing about 25% the power installed in the Cunarders, and with speeds of 16 to 17 knots, the sensation of movement will be lessened. The highly-sensitive passenger may prefer the longer voyage in the slower ship; but those who prefer the faster vessels may be assured of greater comfort than has been hitherto available in fast Atlantic liners.

Brief reference may be made to the behavior of the new vessels in heavy seas. They have been thoroughly tested during the past winter, and the verdict of those who have witnessed their performances is most favorable. The writer has had an opportunity of making personal observations which confirm this verdict, and his study of the subject for 30 years enables him to speak with some authority. For rolling motions the period for a single swing (port to starboard or vice versa) is 11 seconds when the ships are fully laden. As the coal is burned the motion becomes somewhat slower. It is always slow and gentle as compared with nearly all preceding ships, and this fact tends to much greater average steadiness.

The greatest angles of rolling in vessels having these long periods of oscillation occur when the vessels are running away from the sea, and the line of wave advance is considerably abaft the beam. In these conditions there may be approximate synchronism between the periods of the waves and the ships, and rolling motion may accumulate. So far as observations go, no very heavy rolling has occurred, and the motion when at its maximum is always so slow as to be less trying than the corresponding motion in a quicker-rolling vessel. The period for pitching is about one-third of that for rolling and is relatively long; so that in this respect the vessels are exceptionally well situated, as might be anticipated from their great length. They make light of weather that would be seriously felt by most of their predecessors.

Some writers have been disposed to argue that the results obtained in the "Mauretania" when one screw was disabled indicate that three screws are better than four. This contention does not call for serious consideration. There is abundant proof that a high "coefficient of propulsion" has been obtained with the quadruple screws. Judged by that standard they need not fear comparison with triple-screw ships like the "Carmania" and the Allan liners, or with twin-screw ships. Possibly the most efficient forms of screws have not yet been discovered for the Cunarders. But, apart from that possibility, it is obvious that the "Mauretania" must have been worked at a serious disadvantage with one high-pressure turbine idle and with the constant use of helm to keep her on a straight course.

As to details of sea speed, half a knot may appear to be a small difference. But when this is obtained above a speed already very high, it involves considerable increase in the power developed. For smooth water the increase in engine-power to raise the speed from 23 to 23.5 knots would be about 8.5%; the corresponding increase of speed from 24 to 24.5 knots would involve an increase of about 11%. In order to pass from 23.5 knots (the maximum speed of preceding Atlantic steamships) to 25 knots in the new Cunarders, about 33.3% more engine-power must be developed. In steamship propulsion it is the "last step" which costs dearly.

THE PUMPING STATIONS OF THE INTERCEPTING SEWER SYSTEM OF CHICAGO.

The intercepting sewer system of Chicago is an important part of the extensive works undertaken by the city to eliminate the sewage pollution of Lake Michigan, and thus remove the danger of pollution of the city's water supply. It intercepts the sewers that formerly discharged into the lake, and discharges this sewage into the Chicago River. The flow of the river was reversed with the opening of the Drainage Canal, and carries the sewage into the canal.

The intercepting sewer system comprises three sections: 1. The Central Division, which consists of two sewers under 12th and 22d Sts. These serve a large proportion of the sewerage of the more densely populated central section of the city. The sewers north of 12th St. discharge into the main stem of the river. 2. The Southern Division, which consists of a continuous sewer paralleling the lake shore from 73d St. to 35th St. (about 4.75 miles). This delivers the sewage into a 20-ft. tunnel extending 2.3 miles under 39th St. to the south branch of the river. 3. The Northern Division, with a similar sewer near the lake shore from Fullerton Ave. to Bryan Ave. (about 5.5 miles). It delivers the sewage to a 16-ft. tunnel extending about three miles under Lawrence Ave. to the north branch of the river.

It may be noted that part of the southern division main sewer is close to the shore of the lake and in the right-of-way of the Illinois Central Ry. (east of the present railway tracks). This was protected by the railway company's bulkhead wall of piles and stone filling, but the failure of parts of this bulkhead by decay and the effect of storms has caused the waves to attack the filling along the sewer. The sewer was built between continuous lines of Wakefield sheet piling, which protect the sewer at the present time. The city will reinforce this by a revetment of riprap stone on the lake side of the sheeting, as a protection against the waves, on account of the defective condition of the bulkhead wall. This protection will be required only for a length of about 600 ft.

The central division has a gravity flow only. This has been in use since 1898. The other two divisions have pumping plants which deliver both sewage and lake water into the river for the purpose of diluting the sewage. That from the 39th St. pumping station of the southern division, however, serves also as an auxiliary supply to the drainage canal, thus relieving the south branch of the river from the necessity of carrying the entire flow capacity of the canal, which would involve an objectionably swift current.

The southern division has its pumping station at the upper or lake end, being located on the lake shore at 39th St. This has been in operation for about two years, during which time no sewage has been discharged along the lake front between the mouths of the Chicago River and the Calumet River. The northern division has its pumping station near the lake end, at Lawrence and Evanston Aves. The intercepting sewers of this division were completed a few years ago, but the Lawrence Ave. tunnel to the river has been delayed by contractors' difficulties and prolonged litigation. It is now in partial operation, the sewage being discharged into the river, but without dilution. The lake water for dilution purposes will be turned in probably next October, as the intake crib is now under construction.

The intercepting sewer system has been designed and built under the direction of Mr. Wm. S. MacHarg, M. Am. Soc. C. E., Consulting Engineer to the Division of Intercepting Sewers in the city Department of Public Works. The pumping plants have been built and installed by the Allis-Chalmers Co., of Milwaukee, Wis. We are indebted to this company and to Mr. MacHarg for plans, photographs and other information.

39TH ST. PUMPING STATION.

The 39th St. tunnel is 2.3 miles long, with an intake and pumping station at the lake end, as already noted. The tunnel is 20 ft. in diameter, and was designed for a normal flow of 57,000 cu. ft. per minute. For about 3,000 ft. at the west end it was built in open cut, and is of horseshoe section 22½ ft. wide and 18 ft. high. A view of the pumping station is given in Fig. 1. This shows the screens of the intake and also the timber protection which forms the forebay. The general plan, Fig. 4, shows the position of the pumps, and the connections with the intercepting sewer, the tunnel conduit, and the lake. A special feature of the station is the arrangement of the pumps, channels and gates. This is planned to allow great flexibility in handling the normal sewer flow and the additional flow due to storm water, and in admitting from the lake the amount of water needed for the proper dilution of the sewage. The equipment includes four centrifugal pumps and two screw pumps.

The flow from the intercepting sewer enters the pumping station at its southwest corner, at a level 34 ft. below the pump room floor or 20 ft. below datum (low-water level in the Chicago River in 1847). At the connection is a screen chamber, 27 × 28 ft. From this a channel 12 ft. wide and from 32 to 34 ft. below the floor level extends along the side of the building for 130 ft. to the lake front, where it makes a curve of 90° and connects with the gravity channel to the tunnel or conduit. All the channels, pump pits and foundation pits are of concrete. The foundations as originally planned (from surveys made by borings) were to be of the pile and grillage type. But on investigation of the ground by test pit it was decided to support them on concrete piers carried down to hardpan, which is found at an elevation of 29 ft. below datum. This work was done after the site had been surrounded by a cofferdam and the water pumped out, as described in our issue of Dec. 17, 1903.

CENTRIFUGAL PUMPS.—There are four centrifugal pumps. Each has a horizontal runner of the enclosed vane type, on a vertical shaft, driven by horizontal triple-expansion condensing engines. To a crank arm on the upper end of the shaft are attached the connecting rods of the engines, these rods moving in horizontal planes. There is no fly-wheel, but the crank arm has a counterbalance. The general design of pumps of the same type for pumping sewage into the lower end of the southern division of the intercepting sewer was illustrated in our issue of March 31, 1904.

The two smaller pumps (for ordinary sewage) have each a capacity of 75 cu. ft. per sec., against a head of 24 ft. Each pump has a run-

ner 7½ ft. diameter, and is driven by a horizontal triple-expansion Corliss engine with the cylinders set at angles of 120°. The cylinders have diameters of 12, 22 and 32 ins., and a stroke of 30 ins. The two larger pumps (for storm water) have each a capacity of 250 cu. ft. per sec., against a head of 13 ft. Each pump has a runner 9¼ ft. diameter and is driven by an engine of the same type as above described. The cylinders are 16, 30 and 46 ins. diameter, with a stroke of 30 ins. A recent official duty test of these pumping engines showed a duty of from 104,000,000 to 109,000,000 ft.-lbs. per 1,000 lbs. of dry steam. An efficiency of 69% was obtained for the engine and pump combined. Fig. 2 is a view in the engine room, showing the engines of the centrifugal pumps.

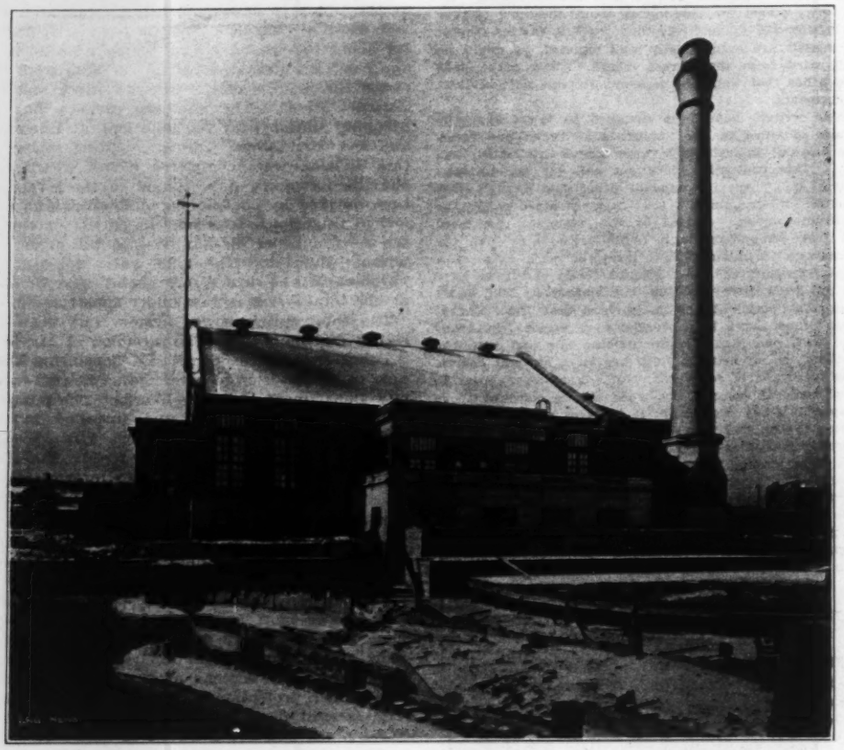


FIG. 1. PUMPING STATION AT 39TH ST. AND THE LAKE FRONT; CHICAGO INTERCEPTING SEWER SYSTEM.

(This station pumps sewage and lake water to the Chicago River and the Drainage Canal.)

The two smaller centrifugal pumps, Nos. 1 and 2, will take care of the dry-weather flow. This now amounts to about 90 cu. ft. per sec., but may eventually reach a maximum of 145 cu. ft. per sec. Ordinarily, therefore, the flow from the intercepting sewers is admitted to these pumps only. They are placed in circular pits, with the suction 19½ ft. below datum (30½ ft. below the floor) and the discharge 17 ft. below datum. The suction connection between each pump and the sewage well is built in concrete. It has an elliptical section 4 × 6 ft. at the well, tapering to a circular section 4 ft. diameter at the pump pit.

The combined flow of sewage and storm water in the intercepting sewers during storms or rainy seasons may reach as high as 666 cu. ft. per sec., and additional pumping capacity is provided to handle and control this. In the channel beyond the screen chamber (Fig. 4) is a sewage chamber, A, having its bottom 25 ft. below datum. This is formed by a cross wall of concrete 8 ft. high, built midway between the screen chamber and the curve to the gravity channel. Above this wall is placed a transverse automatic swinging gate, B, 11½ ft. wide and 20 ft. high. It is hung from its upper edge, so that its lower edge closes against a brass seat on the gate frame. This gate and the cross wall thus seal the sewage chamber from the inlet channel, C, under normal conditions. When the storm-water flow from the sewers rises in the chamber, due to exceeding the capacity of the first two pumps, its pressure forces the gate open and admits the increased flow to the intake of the two larger pumps, Nos. 3 and 4.

The bottom of each of the pits of these latter pumps is 9.5 ft. below datum. The suction connection is similar to that of the smaller pumps. It is 9 × 11 ft. (elliptical) at the sewage well end, and 7 ft. diameter at the pump pit. In order to obtain the best practicable velocity in the sewer, the water surface must be kept at a level 8 ft. or more below datum, depending on the quantity of the combined storm-water and sewage flowing to the well. For these re[illegible] the water level in the well varies from 8 [illegible] ft. below datum. The greater part of the se[illegible] performed by the larger pumps occurs wh[illegible] e level is from 11 to 13 ft. below datum. [illegible] quantity pumped under these conditions ra[illegible]s from 100 to 500 cu. ft. per sec.

When the larger pumps are ha[illegible] the flow from the intercepter, the lift-ga[illegible] is closed. This shuts off the inlet channe[illegible] from the gravity channel, and excludes th[illegible]ke water. The inlet channel, C, and the se[illegible] chamber, A, then form a single main sewag[illegible]ell. When the lift-gate, D, is opened, the s[illegible]-gate, B, will be closed automatically by th[illegible]ater pressure, thus separating the sewage [illegible]mber from the inlet channel.

SCREW PUMPS.—Under ordinar[illegible] conditions the level of Lake Michigan at the i[illegible]ke is fully 14 ins. above that of the river at th[illegible]utlet. This gives a gravity flow through the 39[illegible] St. tunnel. The volume of water thus carried, however, is not always sufficient to give the requisite total flow of lake water in the Drainage Canal. In order to supply the necessary volume, two screw pumps are provided, one or both of which may be used as required. They have each a capacity of 666 cu. ft. per sec. These pumps, E and F, are very similar to the screw pump of the river flushing pump at Milwaukee, Wis., described in our issues of Aug. 1, 1907, and April 23, 1908. They have been installed and the results of their official tests are noted at the end of this article.

Water from the lake is led to these pumps (and also to the channel for gravity flow to the tunnel) through channels from an intake of horseshoe shape in plan, 80 × 80 ft., fitted with screens. This extends 80 ft. into the lake, and is protected by bulkhead walls forming a forebay, with an opening on the south side. The intake discharges into the gravity channel of the pumping station through an opening fitted with a gate, G. Between the gravity channel and the channel leading to the south screw pump, E, is a lift-gate, H. The two openings from the intake to the screw pumps also have lift-gates, I and J. All four lift-gates are operated by motors in the gate house on the lake front. Fig. 9 is an interior view of the gate house, showing the electric hoists.

An hydraulic lock gate, K, seals the gravity channel from the conduit leading to the river. Similar gates L and M close the tail races or discharge conduits of the screw pumps when it is necessary to exclude water from the wheel chambers to allow access to the pump wheels.

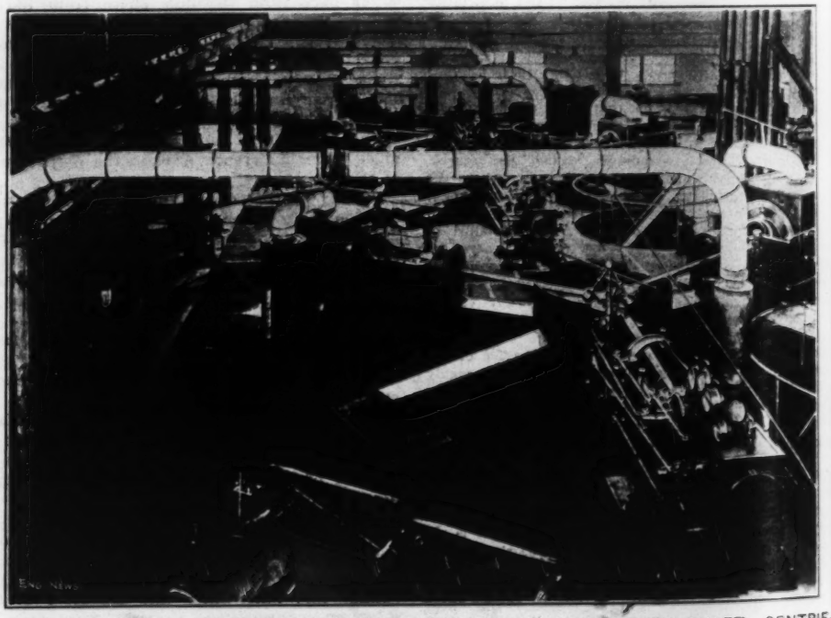


FIG. 2. HORIZONTAL TRIPLE-EXPANSION ENGINES DRIVING VERTICAL-SHAFT CENTRIFUGAL PUMPS; 39TH ST. PUMPING STATION.

These lock gates swing on hinges built into the side walls of each channel. They are opened and closed by oil cylinders operating under 3,000 lbs. pressure. Four sets of vertical guides for timber partitions are formed in the sides of the gravity channel, so that any one of the centrifugal pumps may be temporarily isolated and have its pit emptied, without affecting the operation of the other pumps. Under those circumstances the discharge from such of the units as may be on the lake side of the partition can be sent to the conduit through the south screw pump, E, by closing the lift-gate D and opening gate H. Fig. 5 is a view showing the connection from the sewage channel to the first screw pump. At the left is the gravity channel (Fig. 4), and beyond the opening is the entrance of the channel to the screw pump. The vertical slot in the walls of the opening is for gate H.

Each screw pump is driven by a vertical triple-expansion condensing engine with cylinders 22, 38 and 62 ins. diameter and 42 ins. stroke. The total height of the engines above the foundation is 35 ft. The wheels are 14¾ ft. diameter, each consisting of an hexagonal hub surmounted by six blades or impellers set in the direction contrary to that of a boat's propeller. A cone is placed on each side of the wheel, to direct the flow to and from the blades. The wheel revolves in a cylindrical cast-iron casing set in a concrete cylindrical channel 16 ft. long and allowing a clearance of ¼-in. for the blades. A second casing placed in the channel, just beyond the wheel, contains stationary deflector blades which reduce the swirling motion given to the water by the wheel. The shaft on which the wheel is mounted is carried by an outboard bearing in the center of the second casing, where it is supported by the deflector blades. Each engine is directly connected to its pump wheel by a horizontal shaft, and the pull on the shaft is taken up by a thrust bearing of the marine type, which is placed inside the engine pit. The wheels revolve at 55½ r. p. m.

The engines are peculiar in having the high-pressure and intermediate cylinders placed tandem upon one frame, while another frame carries the low-pressure cylinder. The tandem cylinders (with the high-pressure cylinder on top) are nearest the pump. With this arrangement only two cranks and two main shaft bearings are required. As the screw shaft is driven from the tandem crank by a drag crank, the alinement of the engine shaft is independent of that of the screw shaft.

The connection between the cylindrical channel at the wheel and the rectangular channels at the gates on either side is made by inclining the arch upwards in each direction from the wheel. The connections, therefore, are of oval section, with varying vertical diameters. The inverts of the wheel casings are 21 ft. below mean lake level.

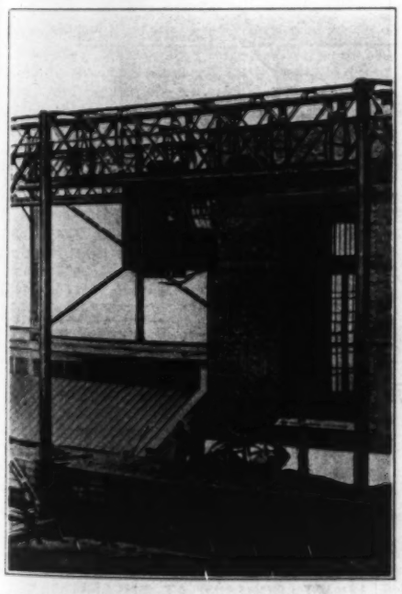


Fig. 3. Coal Handling Plant at the 39th St. Sewage Pumping Station.

The engine pit is located between the two channels leading from the screw pumps. It is oval in plan, 37½ × 45 ft., and is 25 ft. deep. The bottom is 14 ft. below datum, and is anchored to a mass of concrete about 7 ft. thick. The pit is built up of 80 cast-iron sections or panels, as shown in Fig. 6, which is a view of the structure erected in the builders' shops. The sections are approximately 10 ft. square. They are 2 ins. thick, and have internal flanges for bolting. The faces are planed, and lead sheets are fitted at all joints, so as to form a permanent packing which can be calked at any time. The inclined rib showing on one side (and cast with the sections) forms the skewback for the concrete arch of the conduit roof, which rises behind the wheel, as already described. The vertical offsets or ribs on the outside of the pit form joints with the conduit walls, which are thus maintained at their full thickness where they meet the shell of the pit. The total weight of the pit is about 250 tons. The anchorage to the foundation, and the weight of the arches and floors hold the pit down with a force in excess of its flotation when submerged. There is, therefore, no fear of any tendency towards lifting.

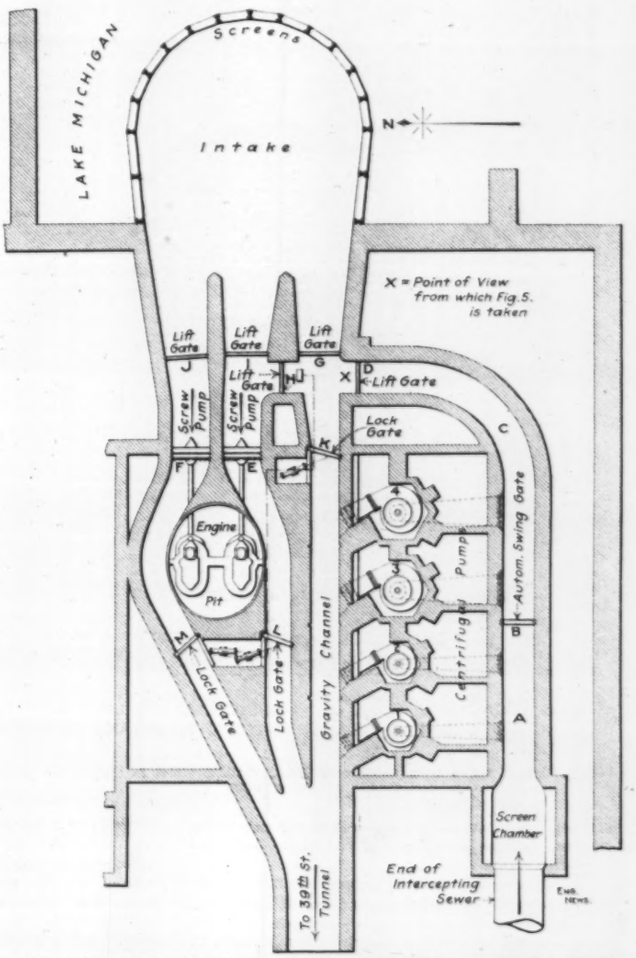


FIG. 4. PLAN OF 39TH ST. PUMPING STATION; SHOWING THE ARRANGEMENT OF PUMPS, CHANNELS AND GATES.

The condensing plant consists of Tomlinson condensers, with 8-in. circulating pumps of the single-stage centrifugal type, directly connected to small engines. Each of the screw pumping engines has its own condenser. There are separate condensers for the four centrifugal pumping engines, but the exhaust piping from these engines is so arranged that any one of them can exhaust into either of the two condensers provided for the screw pumps. The use of centrifugal pumps for the condensers was adopted for the reason that the injection water is impregnated with sewage and contains foreign substances, which would tend to clog up valves and interfere with the action of a piston or plunger. The water passages in the head of the barometric condenser are also designed so that foreign substances in the water may pass through without trouble.

The boilers are of the Aultman & Taylor water-tube type. Each is rated at 264 HP., or a total of 1,584 HP. (on a rating of 10 sq. ft. of heating surface per HP.). They have Mansfield chain-grate stokers, fitted with an improved water-back. They developed 74% efficiency under 58% overload, using Illinois coal screenings. The boilers are served by a chimney 8 ft. 6 ins. diameter and 188 ft. high above the ground. This is of the Alphons Custodis radial brick construction.

Coal cars are switched on a spur of the Illinois Central Ry. under the loop of a steel-truss runway extending over the west end of the boiler room and the coal-storage house. On the runway travels a car with apparatus for handling a grab-bucket. This coal-handling system is shown in Fig. 3. When the loaded bucket is raised, the car carries it around the elevated track to one of two dumping positions; over the coal-storage house, or over a hopper in the end of the boiler house. Thence the coal is taken directly to the magazines of the stokers by a traveling hopper mounted on a four-wheeled truck and running on an elevated track which passes across the boiler room in front of the stokers. The entire handling of coal is done without hand work. Coal in the storage house is handled by the bucket in the same way, the bucket loading the coal into the traveling hopper. The ashes are handled by wheelbarrows, but chutes are formed behind the grates through which they may be delivered to a conveyor in the basement. No conveyor has been installed.

LAWRENCE AVE. PUMPING STATION.

This pumping station was planned originally to be at the lower or outlet end of its tunnel. As constructed, however, it is at the lake or intake end, as in the case of the 39th St. pumping station. A general plan is shown in Fig. 8. There are three horizontal centrifugal pumps, for handling the sewage and storm water. One of these has a capacity of 37.50 cu. ft. per sec., which is estimated to be sufficient for the dry-weather flow of sewage. The others (to handle storm-water) have each a capacity of 125 cu. ft. per sec. They are driven by engines of the same type as those at the 39th St. station. For pumping lake water into the river there is a screw pump having a capacity of 585 cu. ft. per sec. This is of the same type as the screw pumps at 39th St., already described. The sewage pumps are in use and the screw pump is erected

FIG. 5. CONCRETE WORK OF PUMPING STATION, SHOWING OPENING TO CONNECT SEWAGE WELL WITH INTAKE OF SCREW PUMP.

(The view is taken from point x in Fig. 2; Gate H slides in the slot in the walls of the opening.

FIG. 6. CAST-IRON PIT FOR THE VERTICAL ENGINES DRIVING THE SCREW PUMPS AT THE 39TH ST. PUMPING STATION.

(The inclined rib cast on the sections forms the springing line for the concrete arch of the discharge channel.)

but not yet in service. It is ready for use when the lake intake is completed, which is expected to be in October.

The intercepting sewer enters at the southeast corner of the building, and connects with a channel in which is a screen chamber, A. Beyond this the channel forms the sewage well, B. From this the sewage is drawn by the centrifugal pumps and delivered to the discharge channel, C, terminating in the Lawrence Ave. tunnel. At D is a connection for a sewer in connection with sub-main sewers which are to be reconstructed west of the pumping station. The main 16-ft. conduit in Lawrence Ave. is diverted to pass through the pumping station, as shown on the plan. It enters the southeast corner of the building, makes a right angle bend (of 22.3 ft. radius on the center line) past the pump pit, and returns to Lawrence Ave.

The wheel of the screw pump is placed at E, and the circular section of the conduit is gradually reduced to 13½ ft. diameter at the wheel. Gates are provided to allow of shutting off the channel on each side of the wheel. These gates are of particular interest. They are of cast iron, and slide vertically in slots in the walls of the 13½-ft. channel. Owing to the great size, each gate is cast in two parts; these are put together with a vertical flange and bolted joint. To each side of the gate is attached a sprocket chain. These pass over sprocket wheels on a shaft above the gate slot, and thence horizontally to similar wheels on another shaft which is driven by gearing from an electric motor. The chains are not wound upon a drum, but hang loosely from the rear sides of the driving sprockets.

The arrangement of the two gates (on opposite sides of the pump wheel), with their operating machinery, is shown in Fig. 7.

A by-pass connection between the intercepting sewer and the lake water conduit is provided at F. Thus the sewage can be pumped by the screw pump in emergency, or in the event of repairs being made to the three centrifugal pumps or the sewage well. All the foundation work is carried down to hardpan, as shown by the section in Fig. 8.

TESTS OF THE SCREW PUMPS AT THE 39TH ST. PUMPING STATION.

The official duty tests of the screw pumping engines at the 39th St. station were made in May, 1908, under the direction of three experts: Mr. Henry A. Allen, Consulting Engineer, representing the Sanitary District; Mr. L. E. Strothman, representing the Allis-Chalmers Co., and Mr. Wm. J. Jennings, Consulting Engineer, representing Robert W. Hunt & Co. For particulars of the tests we are indebted to Mr. Allen.

The contract called for two vertical triple-expansion condensing Reynolds-Corliss engines, each connected to a screw pump. Each unit was designed to raise 666 cu. ft. of water per sec. against a static head of 7 ft., and to be capable of delivering an equivalent quantity against a head of 10 ft. Each unit was designed

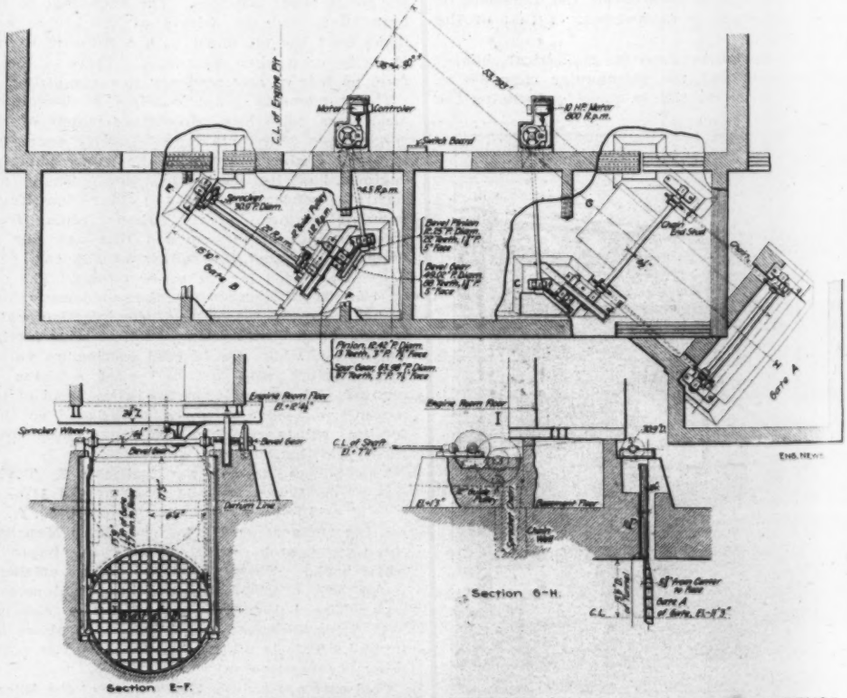


FIG. 7. GATES AND GATE MACHINERY FOR THE 13½-FT. CONDUIT AT THE LAWRENCE AVE. PUMPING STATION.

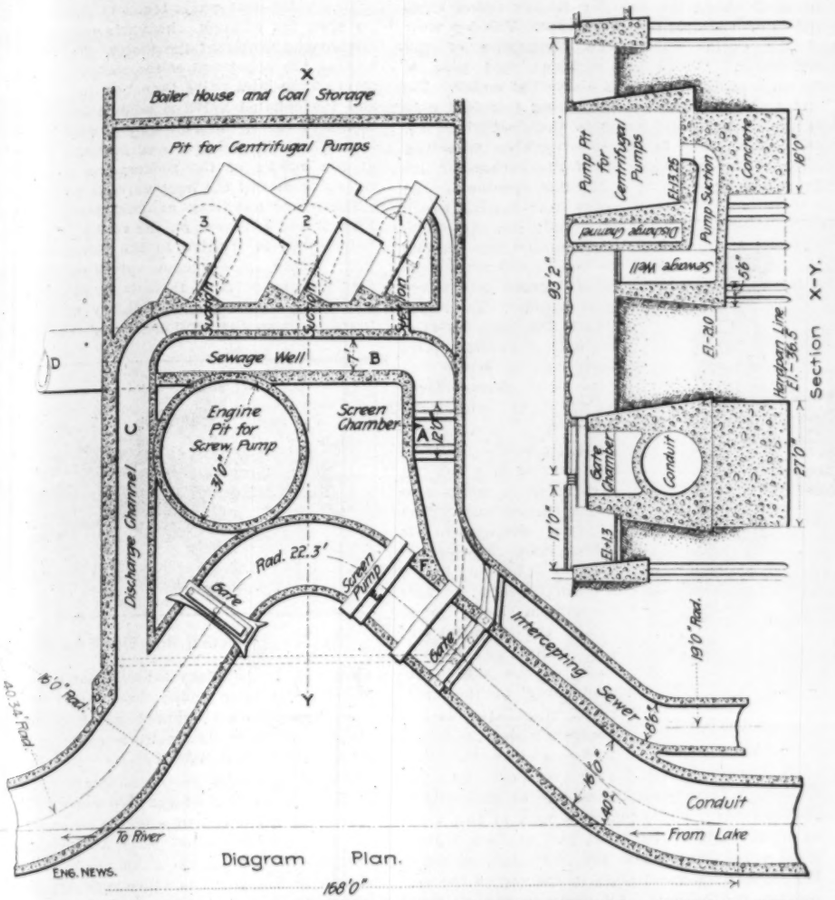


FIG. 8. PLAN AND SECTION OF LAWRENCE AVE. PUMPING STATION; CHICAGO INTERCEPTING SEWER SYSTEM.

also so that it could be made to give the maximum efficiency attainable for any head between 5 ft. and 10 ft. The engines were designed for a working steam pressure of 170 lbs. The pump and thrust bearings were designed for pressures due to a head of 10 ft.

The contract provided also that the pump should be tested when working against a head of between 6 and 7 ft., this head to be the static head between points about 20 ft. ahead of the screw and 60 or 70 ft. behind the screw. Under these conditions the builders guaranteed for each unit a duty of not less than 95,000,000 ft.-lbs. per 1,000 lbs. of steam containing less than 2% of moisture. The tests showed a duty of 145,347,847 ft. lbs. for the south unit, and 150,681,634 ft. lbs. for the north unit. The summarized details of these tests are given in Table I. The results of tests of a tandem-compound screw pumping engine for the Kinnickinnic River flushing plant at Milwaukee, were given in our issue of April 23, 1908.

The accurate measurement of the large quantity of water to be pumped (666 cu. ft. per sec.) was considered a difficult problem, and it was decided that the greatest accuracy could be obtained by using current meters. Four current meters were ordered from W. & L. E. Gurley, and were mounted in a steel frame suspended across the discharge channel. The frame was held in vertical guides. The meters were placed in two positions on the frame, making eight points of observation in each horizontal line. These observations were made at vertical intervals of about 22 ins. Thus there were eight observations for each of 15 horizontal lines at varying depths. The velocities at the 120 points of measurement in the cross section of the channel for the south pump ranged from a minimum of 1.89 ft. per sec. near the top to a maximum of 3 ft. per sec. near the bottom. For the north pump the range was from 1.72 ft. to 3.86 ft. Tests of the weight of water gave an average of 62.42 lbs. per cu. ft.

In addition to the duty tests above noted, capacity tests were made by Mr. Allen. These were made under a clause of the specifications which states that during excessively heavy rainfall, one of the pumps will be required to raise and deliver 22,000 cu. ft. of storm water per min. to a height of 10 ft. This must be done without undue strain or loss of efficiency. The engine must work smoothly and economically and at a moderate rate of speed. The capacity tests were made for a three-hour run with each engine. A summary of the results is given in Table II.

TABLE I.—OFFICIAL DUTY TESTS OF SCREW-PUMPING ENGINES AT THE 39TH ST. PUMPING STATION; CHICAGO.

Engine	North	South
Date (1908)	May 15-16	May 11-12
Duration of test, hours	24	24
Barometer, ins. mercury	29.471	29.06
Barometer, lbs. per sq. in.	14.47	14.27
Pressure; steam per sq. in. at throttle, absolute, lbs.	185.56	184.43
Steam per sq. in. at throttle, gage, lbs.	171.09	170.16
1st receiver, gage, lbs.	22.59	24.09
2d receiver, gage, lbs.	—1.22	—0.24
1st reheating coil, gage, lbs.	38.02	34.53
2d reheating coil, gage, lbs.	0.7	1.206
Calorimeter manometer, ins. of mercury	6.18	6.46
Vacuum (ins. of mercury), exhaust pipe at condenser	26.49	26.60
Water level, suction, ft. below datum	1.439	.713
Discharge, ft. above datum	5.635	6.352
Head total, ft.	7.074	7.065
Temperature, at eng. throttle (°F.)	375.48	374.97
At exhaust at condenser	115.15	109.30
Hot-well	63.76	59.55
In calorimeter	286.81	289.52
Circulating water	50.2	49.56
Water pumped	50.7	50.00
Engine room at barometer	81.37	78.70
Water, feed to boiler; total lbs.	189,680.5	194,886.0
Leakage from boilers, total, lbs.	5,145.1	4,365.0
Returned from traps, total, lbs.	7,458.0	7,272.0
Chargeable to calorimeter, total, lbs.	1,393.0	1,384.5
Steam used by engine, total, lbs.	175,684.4	181,844.0
Steam, quality, per cent.	98.177	98.35
Revolutions main engine, total	75,400	77,262
Revs. per min., main engine, ave.	52.361	53.654
Circulating engine, average	346.38	319.02
Piston speed; ft. per min., average	306.53	375.58
Discharge channel, average width at meters, ft.	9.929	10.125
Ave. depth at meters, ft.	26.645	26.463
Ave. cross-sec. area at meters, sq. ft.	264.558	267.938
Ave. velocity at meters, ft. per sec	2.623	2.589
Capacity, water pumped, ave. cu. ft. per sec.	693.935	693.691
Weight of one cu. ft. of water lifted, lbs.	62.416	62.419
Foot-pounds, average per sec. (average cu. ft. per sec. to average head)	306,393.665	305,910.957
Water HP., ave. measured	557.08	556.20
Steam I. HP., main engine, ave. from cards	641.54	690.72
Circulating eng., ave. from cards.	12.03	10.22
Total	653.57	700.94
Mechanical efficiency combined, %	85.20	79.30
Saturated steam per I. HP. per hr.	11.20	10.81
Official duty per 1,000 lbs. steam	150,681,634.46	145,347,847.70

TABLE II.—CAPACITY TESTS OF SCREW PUMPING ENGINES.

	North engine.	South engine.
Average r. p. m.	56.910	57.555
Total I. HP.	913.770	937.400
Suction head, ft.	2.975	6.690
Discharge head, ft.	7.136	3.499
Total head, ft.	10.111	10.189
Vel. of discharge, ft. per sec.	2.409	.....
Ave. capacity, cu. ft. per sec.	673.223	664.000

FIG. 9. INTERIOR OF GATE HOUSE, WITH ELECTRIC HOISTS FOR HANDLING LIFT GATES.

A GASOLENE MOTOR WITH ROTATING CYLINDERS.

The motor described in what follows, in some respects, might be termed a rotary gasolene engine. However, it carries cylinders in which pistons reciprocate as in an ordinary gas engine. The motor is a four-stroke cycle machine and the power is derived from the explosion of a mixture of gasolene vapor and air between the piston and cylinder head as in ordinary internal-combustion engines. Instead of fastening down the cylinder and causing a crank shaft to revolve, as in an ordinary engine, here the crank shaft is fixed and the torque resulting from the explosion pressure causes the frame, holding the cylinders, to revolve. This idea of revolving the cylinders instead of a wheel driven from pistons has been used by many inventors before and this particular design has previously been adapted to automobile work and it is now proposed to use it for aeronautic experiments, on account of its lightness. The makers claim that the engine herein illustrated, weighing about 97 lbs., will develop 36 B.H.P. This engine has five cylinders of 4½-in. bore and 3½-in. stroke, and may be operated safely up to a speed of 1,800 r.p.m. However, when the engine is heavily loaded the speed may be reduced to 80 r.p.m. A normal running speed is about 300 or 400 r.p.m.

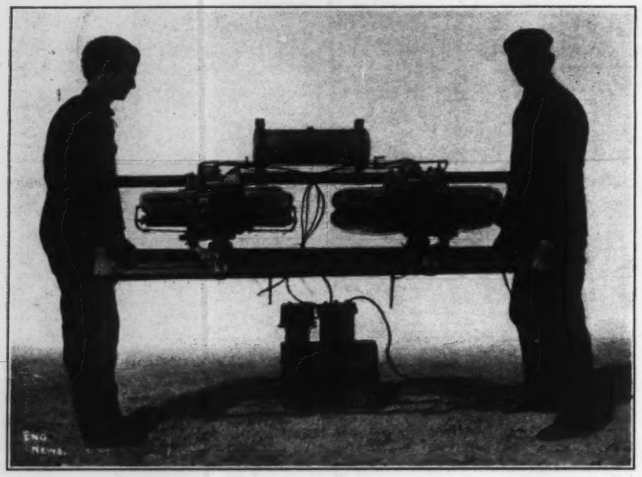


FIG. 1. TWO FIVE-CYLINDER, FARWELL GASOLENE MOTORS, MOUNTED ON STEEL TUBES.
(One at right in operation.)

CYLINDERS, PISTONS, ETC.—Fig. 3 shows the five bronze connecting rods which are interlaced, in the position shown, about the single crank pin of the shaft of Fig. 4. On the lower end of this crank shaft there will be noticed two milled faces, where the shaft is to be keyed to the supporting base. In this case the base is an aluminum casting clamped to four 2-in. steel tubes as shown in Figs. 1 and 7.

The relative movements of cylinders, pistons and connecting rods will be understood by reference to Fig. 5, which shows a horizontal section of the motor in a plane bisecting the cylinders. The center O_1 is the center of the two main bearings about which the cylinders revolve as one piece. As indicated, these cylinders are separate castings bolted together and also bolted to top and bottom flanges, completing the crank case, as may be seen in Fig. 2. At the same time the top flange is arranged to serve as a gas manifold pipe, while the bottom one transmits the power developed to a large spur gear, carried by the aluminum base. The center, O_2, Fig. 5, is the center of the crank pin on which the five connecting rods are assembled. As the connecting rods are of the same length, the piston pins follow each other in a circle about O_2. As the centers, O_1, and O_2, are eccentric to each other, the revolution of the cylinders and connecting rods about these different centers gives the desired piston travel.

CARBURETOR.—The carburetor may be seen in Fig. 2. It is a part of the aluminum casting mounted above the cylinder set, or crank case, and is of a simple float-feed type. The top view of the engine shows the disposition of the carburetor. The small gasolene feed pipe is shown leading off to tank above the motor. Directly above the union connecting this feed pipe to the carburetor casting is the float chamber, and above this is the needle-valve adjusting screw. The spray nozzle of the carburetor delivers the gasolene to a circular opening in the crank-case casting which is cored out to form the manifold pipe leading to the aluminum intake pipes located one above each cylinder. The vapor travels the same distance to each cylinder inlet valve and is driven out toward these valves partly by centrifugal force.

OILER. — The aluminum casting in which the carburetor is built also forms the oil tank. The oiling mechanism is driven from the electric-ignition timer by a worm gear. This mechanism looks much like the cylinder of an ordinary revolver. Each of the holes, corresponding to the cartridge chambers, carries plungers which are driven first one way and then the other by two stationary face cams placed one at each end of this cylinder. These plungers suck in two drops of oil at their lowest point and at their highest point expel this oil into the two tubes, shown in Fig. 7, leading to oil holes in the top of the stationary crank shaft. All ports in the oiler are opened and closed by the movement of one revolving part and there are no springs and check valves. The oil, after entering the crank shaft, is distributed to the cylinders by centrifugal action. One of the oil tubes shown supplies the crank-pin bearing. All the surplus oil settling to the bottom of the motor passes over the lower shaft bearing. The upper shaft bearing must be oiled by hand.

VALVE GEAR.—The inlet valve is the upper one seen on each cylinder, in Fig. 2, and the lower one is the exhaust. The rocker arm at the end of each cylinder is connected to the stems of the inlet and exhaust valves and to the valve rod seen under each cylinder. It is especially notable that no fulcrum is provided between the two valve stems and no springs are required to hold the valves closed. Centrifugal force acting on the valve-gear parts tends to close all valves. To open the exhaust, the valve rod is pulled in toward the center of the motor. The pivot connecting the upper end of the rocker arm with the stem of the inlet valve then becomes a fulcrum and the exhaust valve is pushed open. To open the inlet valve, the pull on the valve rod is released and the rod is moved outward. The pivot at the middle of the rocker arm now becomes the fulcrum and the inlet valve is pushed open.

There are auxiliary exhaust ports, shown on Figs. 2 and 7, placed on the rear side of the cylinder; that is relative to the direction of rotation. There are no check valves on these auxiliary exhaust ports as there is no exhausting into a muffler and hence no liability of drawing in burned gas on the suction stroke. The two studs shown at the auxiliary exhaust ports are to hold baffle plates upon which the exhaust is muffled. The high-pressure exhaust gases come out of these ports so that no noise is made at the main ports. With the baffle plates left off, only a slight noise results at the auxiliary ports.

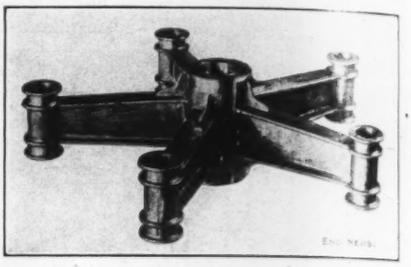


Fig. 3. Connecting Rod Set; Farwell Motor.

The arrangement of the five valve rods in radial positions makes it possible to operate them all at the proper time, with a single cam. An outline (bottom view) of the cam employed is shown in Fig. 6. The valve rods are pivoted to levers whose wiper shoes bear on the periphery of the cam and are pivoted at equidistant points about the cam. This cam has a bearing around a sleeve connecting the cast-steel flange, to which the cylinders are bolted, with the large spur gear seen next to the cast aluminum base in Fig. 2. The cam is made to revolve, by a train of spur gears, in the same direction as the motor, but at a lower speed, the ratio being 6 to 5. The cam, therefore, makes one revolution relative to the cylinders while the cylinders make six revolutions about the crank shaft. For a five-cylinder, four-stroke cycle engine it is necessary then that the cam should be laid out to represent three complete cycles or 12 piston strokes.

On Fig. 6, the radius R_1 is such that the valve rod is moved way out from the center of the motor and the intake valve is opened; R_2 has such a value that both valves are closed and R_3 is

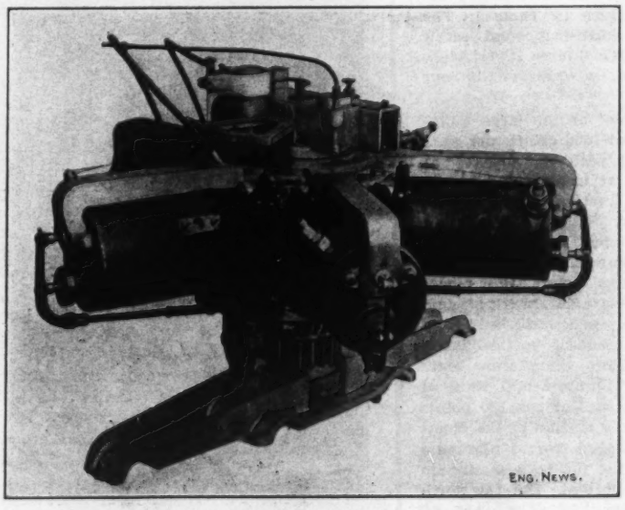


FIG. 2. A SINGLE FARWELL, FIVE-CYLINDER GASOLENE MOTOR, COMPLETELY ASSEMBLED.

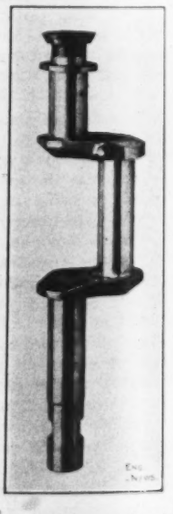


Fig. 4. Stationary Crank Shaft: Farwell Motor.

such that the valve rod is drawn way inward and the exhaust valve is open.

The full line in Fig. 6 represents that part of the cam which revolves in a fixed relation to the cylinders. The dotted line represents a movable section of the cam which, although revolving with, and at the same speed of, the rest of the cam may be moved somewhat relatively to the rest of the cam. This auxiliary cam controls the cuit. This high tension discharge will then pass from the induction coil to the distributing arc, will jump from there to the spark-plug connection, will jump the ignition spark gap, in the cylinder, to the framework of the motor and thence back to the secondary of the coil.

When a cylinder has completed its exhaust stroke, its spark-plug connection is passing under the distributing arc, but, as the timer does

COOLING.—The principal advantage claimed for this design is in the feature of perfect air cooling without auxiliary apparatus of any sort. The revolving cylinders act in the nature of blades of a fan except that they discharge air more or less tangentially to their outer circle. The air attains its highest velocity at the ends of the cylinder where the greatest cooling effect is desired.

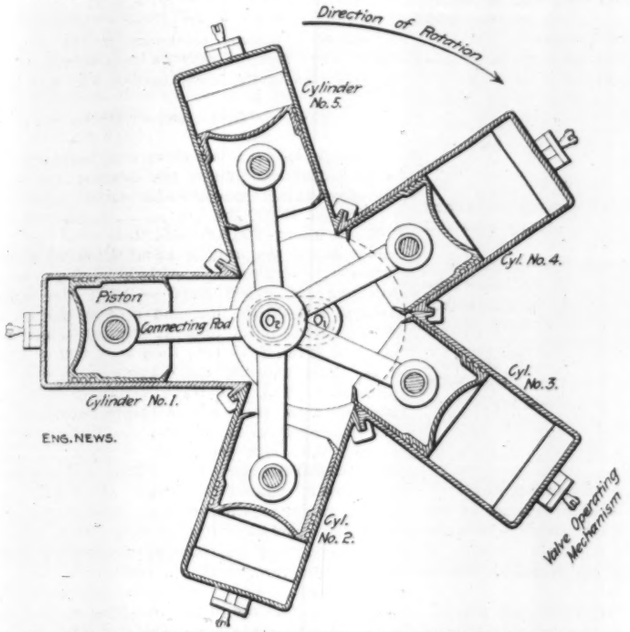


FIG. 5. CROSS-SECTION OF CYLINDERS AND CRANK CASE: FARWELL GASOLENE MOTOR.

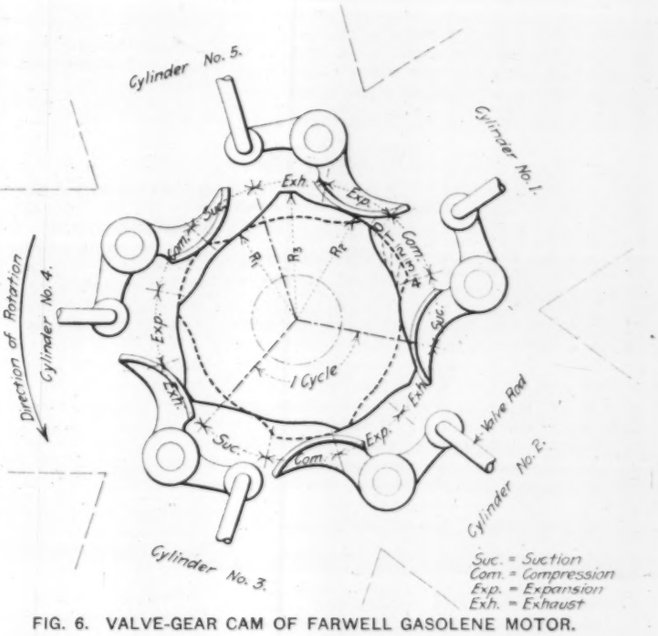


FIG. 6. VALVE-GEAR CAM OF FARWELL GASOLENE MOTOR.

closing of the inlet valve and by this action the engine is controlled.

CONTROL.—To reduce the power of the engine from its maximum, the cam can be changed so that the inlet valves are held open for a part of the compression stroke. This allows a part of the combustible mixture to be blown back into the intake channel and manifold to serve another cylinder; none of the mixture is discarded. Referring again to Fig. 6, at the right side of the cam will be seen additional dotted lines and the figures, 0, 1, 2, 3, and 4, indicating possible positions of that point of the auxiliary port of the cam which closes the inlet valve. With the auxiliary cam set at 2, about half the gas will be retained in the cylinder. At 4 the whole charge is retained and at 1 the inlet valve is not closed until ignition. For the position 1, of this auxiliary cam, only a small charge of gas, at atmospheric pressure, is fired, giving but little power. It is claimed as a great advantage of this method of control that the passage of gas is not restricted, as with a throttling governor, and that there is no tendency for the cylinder, on the suction stroke, to act as a vacuum pump and resist its down travel. The makers claim the ability to fire a thinner mixture, or a smaller charge of gas with this engine than can be done with any other, as centrifugal action forces the heavier part of the mixture to the ignition end, so that it is more easily fired.

IGNITION.—From Fig. 2 it will be seen that each spark plug is connected to a screw at the top of a fiber insulator, and that these insulators are attached to the motor at points midway between the cylinders. The screws in the fiber are adjusted so as to allow, above them, the free passage of the brass arc, seen in Fig. 2. This arc is supported by an aluminum sector but insulated from it by a fiber arc. The sector is adjusted so that, as a piston approaches a cylinder head, that fiber insulator carrying the spark-plug connection for this cylinder is under the distributing arc. Thus when any cylinder reaches the firing point its secondary ignition circuit is properly arranged for the passage of the jump spark when the timer shall close the primary circuit now close the primary circuit, no spark passes in the secondary circuit.

Figs. 2 and 7 show this timer, above the lower cylinder, with the cover in place hiding the interior. One wire of the primary circuit is attached to a binding post which is insulated by a fiber block, from the aluminum casting in which the timer is housed. This binding port connects to a steel spring at the opposite side, of the timer box, from the cover. A roller is free to revolve, but it is eccentrically mounted on the shaft which carries it. This shaft is made to run at 2½ at times the engine speed so that a contact is made between the roller and the flat steel spring at each 144° of main cylinder-set travel. The primary circuit runs from the battery to the primary of the induction coil, thence to the timer and to the engine frame and from this to the battery. Only a single spark-coil and battery set is necessary for all five cylinders.

These novel details are the work of Mr. F. O. Farwell, General Superintendent of the Adams Co., of Dubuque, Ia.

THE ADDITION OF PUZZOLANA TO CEMENT or lime to increase the resistance of concrete and mortar in sea-water has recently been advocated again by officials of the French Corps of Ponts et Chaussees, who have been conducting lengthy experiments upon the subject. From the experiments they have decided that the addition will add both to the strength of the mortar and to its ability to resist disintegration in the sea-water. In preparing the mixture it is recommended that the puzzolana be ground to the same fineness as the cement or lime, that it be mechanically mixed until a perfect combination is assured and that, with Portland cement, the proportions should be by weight, two of cement to one of puzzolana. With other kinds of hydraulic limes or cements, the degree of mixture should be determined by a series of tests, in solutions of sulphate of magnesia, the degree of decomposition indicating the relative ability to resist sea-water.

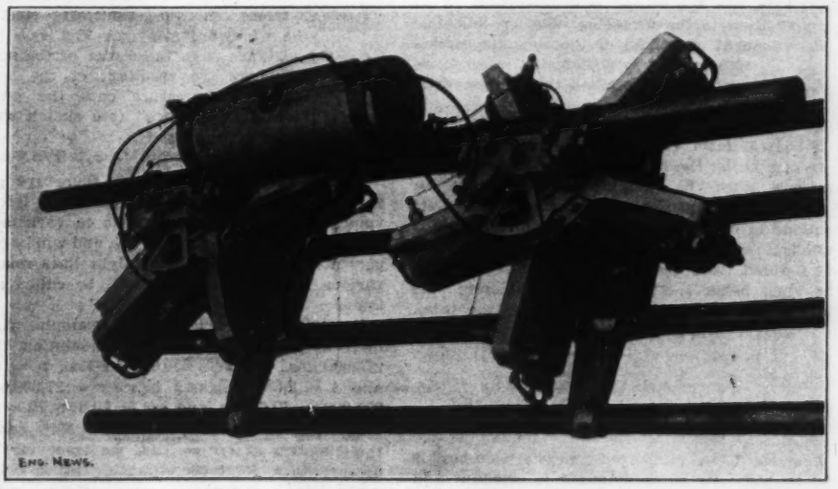


FIG. 7. TWO FARWELL MOTORS MOUNTED ON TUBE FRAME.

WIND STRESSES IN REINFORCED-CONCRETE CHIMNEYS, AND A DIAGRAM FOR THEIR DETERMINATION.

By E. R. MAURER.*

On a horizontal section of a chimney sustaining no wind pressure, the fiber-stress in the concrete is a uniform compression. Wind pressure will change this uniform stress—producing shear also, not considered in this article—increasing the intensity of the compression on the lee side and decreasing it on the windward. The decrease may be larger than the pre-existent intensity, the net result being a tensile stress. Two cases will be distinguished; in both it is assumed, just as in the most widely used flexure formulas for the working strength of an ordinary reinforced concrete beam, that the fiber stress is a uniformly varying one.

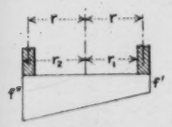


Fig 1

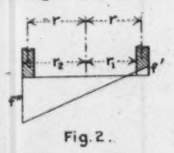


Fig. 2.

Figs. 1 and 2. The Reinforced-Concrete Chimney for Condition of No-Tension or Tension of Slight Amount.

CASE 1. NO TENSION.—*The stress at the windward side remains compressive or becomes a tension of low intensity, say less than 50 lbs. per sq. in.* (see Figs. 1 and 2.) Determination of the intensity, or unit stress, at any point of the cross-section is comparatively simple, for the ordinary method of combining direct and flexural stress applies. Thus let

A = area of chimney section under consideration,
W = weight of superincumbent portion of chimney,
M = bending moment at the section,
f' = unit-stress in concrete at the windward side,
f'' = unit-stress in concrete at the lee side,
n = ratio of the modulus of elasticity of steel to that of concrete (taken as 15 in all numerical work following) and
I = moment of inertia of the composite section about a diameter, computed as explained below;

then

$$f' = \frac{W}{A} - \frac{M r_2}{I},$$

$$\text{and } f'' = \frac{W}{A} + \frac{M r_2}{I}$$

If, in a given instance, f' comes out negative, then the stress at the windward side of the section under consideration is tensile. The greatest compressive unit-stress in the steel is less than nf'', and, if some of the steel is under tension, its greatest tensile unit-stress is less than nf'. The first of these maxima is safe if f'' is safe, and the second is insignificant.

In addition to the foregoing notation let

I_c = moment of inertia of the concrete section with respect to a diameter,
I_s = moment of inertia of all the steel sections with respect to same line,
A_s = total area of all steel sections, and
p = steel ratio, that is A_s/A.

In computing the moment of inertia I, the steel sections must be weighted n-fold; that is, $I = nI_s + I_c$. Instead of using the actual steel sections to compute I_s, one may substitute with sufficient accuracy the section of a cylindrical shell rolled from the steel, the mean radius of the shell being r. Then, as the concrete sectional area is practically the same as the total,

$$I = n A_s \frac{1}{4} r^2 + A \frac{1}{4} (r_1^2 + r_2^2)$$

$$= \frac{1}{4} A (n p r^2 + r_1^2 + r_2^2)$$

Example 1.—A reinforced-concrete chimney is 150 ft. high; its outer diameter is constant and equal to 12 ft. 2 ins.; the upper 100 ft. of the shell is 6 ins. thick and the lower 50 ft. is 8 ins. thick. At a section 50 ft. from the top, the vertical reinforcement consists of 16 ¾-in. rods. The extreme unit-stresses at this section are required, the chimney being under wind pressure assumed to be equivalent to 30 lbs. per square foot of projected area.

Taking the weight of concrete at 150 lbs. per cu. ft., W is about 137,500 lbs., and M about 5,475,000 in.-lbs. Since $A_s = 7.07$ sq. ins. and $A = 2{,}636$ sq. ins., $p = 0.0027$; also

$I = \frac{1}{4}\ 2{,}636\ (15 \times 0.0027 \times 70^2 + 67^2 + 73^2) = 6{,}597{,}000$ ins⁴.

Then

$$f' = \frac{137{,}500}{2{,}636} - \frac{5{,}475{,}000}{6{,}597{,}000}\ 73$$

$= 52 - 60 = -8$ lbs. per sq. in.;

hence there is but slight tension on the windward side, the stress-condition at the section *does* fall under Case 1, and

$f'' = 52 + 60 = 112$ lbs. per sq. in.

Example 2.—At the section 100 ft. below the top of the chimney the vertical reinforcement consists of 48 ¾-in. rods; it is required to determine the extreme unit-stresses there.

Here W is about 275,000 lbs. and M about 21,900,000 in.-lbs.; $A_s = 21.2$ sq. ins., $A = 2{,}636$ sq. ins., $p = 0.008$, and $I = 6{,}864{,}000$ ins⁴. Then

$$f' = \frac{275{,}000}{2{,}636} - \frac{21{,}900{,}000}{6{,}864{,}000}\ 73$$

$= 104 - 233 = -129$ lbs. per sq. in.;

that is, there is a considerable tension at the windward side, and while good concrete in small specimens can withstand a static tension of this value, the computation for stress should be made by the method of Case 2.

CASE 2. TENSION ON WINDWARD SIDE.—*The wind pressure is so great that the resultant stress at the windward side is a tension whose intensity is so high that the concrete has been cracked or is near the cracking stage*; in other words, the tensile stress-condition resembles somewhat that at the section of maximum moment in an ordinary reinforced-concrete beam under full safe load. In the computation for this case, the tensile strength of the concrete will be entirely neglected, as is almost universally done nowadays for concrete beams.

Practical rational formulas for unit-stresses for this case cannot be deduced. But a rational diagram can be constructed by means of which unit-stresses can be easily determined for any section of a given chimney; also the amount of vertical reinforcement required at any section of a given concrete shell can be readily determined by it. Such a diagram (Fig. 3) will now be described by example, and then the analysis on which its construction is based will be given.

In addition to the foregoing notation, let

f_c = unit-stress in concrete adjacent to the remotest steel on the lee side (see Fig. 4),
f_s = unit-stress in the remotest steel on the windward side (see Fig. 4),
e = the distance from the center of the section to where the resultant of the weight and wind pressure cuts the section, "eccentric distance" (see sketch on the diagram,
m = a coefficient such that $f_s = mW/A$.

At the base of the diagram there are given values of "eccentricity," e/r, and at the left side values of m. The curves relate to various percentages of steel, from 0 to 4%, and will be called percentage-lines; and the straight lines relate to various ratios of f_s/f_c and will be called ratio-lines.

Example 3.—The last-given example will be used as illustration. From its solution, $W = 275{,}000$ lbs., $M = 21{,}900{,}000$ in.-lbs., $p = 0.8\%$, and $A = 2{,}636$ sq. ins.; hence $e = 21{,}900{,}000 \div 275{,}000 = 79.6$ ins., and $e/r = 79.6 \div 70 = 1.14$; also $W/A = 104$ lbs. per sq. in. Now entering the diagram at $e/r = 1.14$, we trace vertically upward to a point corresponding to an 0.8 percentage-line, and then horizontally to the left side, taking out the value $m = 3.65$. We also note that the turning point is practically the 20 ratio-line. Hence

$f_c = 3.65 \times 104 = 380$ lbs. per sq. in.,
$f_s = 20 \times 380 = 7{,}600$ lbs. per sq. in.

It may be noticed that f_c is not the unit-stress at the remotest fiber, and hence not the maximum compressive unit-stress in the section. The maximum can be readily computed from

$$f'' = f_c + \frac{t}{4r}(f_c + f_s/n)$$

in which t denotes thickness of the concrete shell. (The formula may be deduced from similar triangles in the lower part of Fig. 4.)

$$f'' = 380 + \frac{6}{280}(380 + 500) = 399 \text{ lbs. per sq. in.}$$

Example 4.—How much vertical reinforcement is needed at the base of the chimney, the working strengths of concrete and steel being limited to 500 and 15,000 lbs. per sq. in. respectively?

W is about 456,000 lbs., the wind pressure about 54,750 lbs., and M about 4,106,000 ft.-lbs.; hence $e = 4{,}106{,}000 \div 456{,}000 = 9$ ft. = 108 ins. and $e/r = 108 \div 69 = 1.56$. The section area A is 3,490 sq. ins., and $W/A = 130$ lbs. per sq. in., hence if the amount of steel is just sufficient to make $f_c = 500$, then $m = 500 \div 130 = 3.85$. Now entering the diagram at $e/r = 1.56$ and $m = 3.85$, we trace vertically and horizontally from these places respectively and note the intersection at about $p = 1.9\%$ and $f_s/f_c = 19$. With this percentage of steel, $f_s = 19 \times 500 = 9{,}500$ lbs. per sq. in. (This is a low working stress; use of a thicker shell will make higher values possible without increase of amount of steel. Several trial sections with different thicknesses may be quickly analyzed by means of the diagram, and an economical size determined.)

Analysis for the Diagram.—The ring NPNQ (Fig. 4) represents a section of a chimney, NN the neutral axis, and NQN the compression

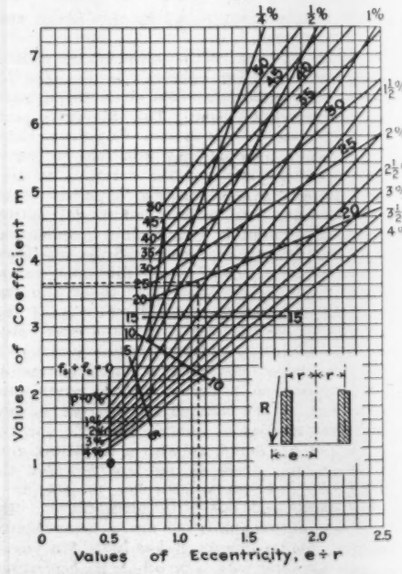


Fig. 3. Diagram of Stress-Coefficients for Reinforced-Concrete Chimneys with Tension on Windward Side.

area (the wind blowing from the right). In addition to the foregoing notation, let

C_c = resultant compressive stress in the concrete,
C_s = resultant compressive stress in the steel,
T_s = resultant tensile stress in the steel,
a_c = arm, with respect to the center O of the chimney, of the resultant compression $C_c + C_s$,
and a_t = arm, with respect to the center O of the chimney, of the resultant tension T_s.

Now the resultant normal stress on the section equals the superincumbent weight, and the re-

*Professor of Mechanics, University of Wisconsin, Madison, Wis.

ing moment equals the bending moment, that is

$$C_c + C_s - T_s = W \quad \ldots\ldots(1)$$

and $(C_c + C_s)\, a_c + T_s\, a_t = M$ $\ldots\ldots(2)$

These two equations constitute the basis of the solution; however, they must be modified conveniently, and this will be done presently. Let

x_1 = distance from NN to the centroid of the arc NPN,

x_2 = distance from NN to the centroid of the arc NQN,

k_1 = radius of gyration with respect to NN of arc NPN,

k_2 = radius of gyration with respect to NN of arc NQN,

θ = angle NOP.

In the case of a uniformly varying stress, the average unit-stress for any portion of the section equals the actual unit-stress at the centroid

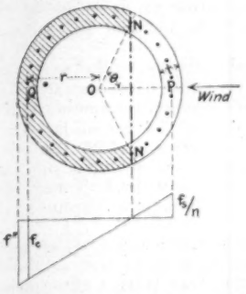


Fig. 4. The Reinforced Concrete Chimney for Condition of Tension on Windward Side.

of that portion (or at any point of the section whose distance from the neutral axis equals that of the centroid). Since the area of the section of the compressive concrete is practically $A\,(1 - \theta/\pi)$, that of the section of the compressive steel $pA\,(1 - \theta/\pi)$, and that of the tensile steel $pA\,\theta/\pi$, it follows that

$$C_c = \frac{1 - \theta/\pi}{1 + \cos\theta}\,\frac{x_2}{r}\,f_c A\,;$$

$$C_s = \frac{1 - \theta/\pi}{1 + \cos\theta}\,\frac{x_2}{r}\,n\,p\,f_c\,A\,;$$

and $$T_s = \frac{\theta/\pi}{1 + \cos\theta}\,\frac{x_1}{r}\,n\,p\,f_c\,A.$$

These values of C_c, C_s and T_s substituted in Eq. 1 give

$$(1 - \theta/\pi)\,\frac{x_2}{r}\,(1 + n\,p) - (\theta/\pi)\,\frac{x_1}{r}\,n\,p = \frac{W}{A\,f_c}\,(1 + \cos\theta) \quad \ldots(3)$$

From any source of information on the centroid of a circular arc, it can be shown that

$$x_1 = r\left(\frac{\sin\theta}{\theta} - \cos\theta\right),$$

and $$x_2 = r\left(\frac{\sin\theta}{\theta} + \cos\theta\right).$$

Imagining these values substituted in Eq. 3, it will be seen that the left-hand member is a function of θ, n and p only. Denoting this function by $F_1\,(\theta, n, p)$, the equation can be written thus,

$$f_c = \frac{1 + \cos\theta}{F_1(\theta, n, p)}\,\frac{W}{A}\,; \quad \ldots\ldots(4)$$

hence, also $$m = \frac{(1 + \cos\theta)}{F_1(\theta, n, p)} \quad \ldots\ldots(I)$$

In the case of a uniformly varying stress, the point of application of the resultant of the stresses on any portion of the section lies at a distance from the neutral axis equal to the ratio between the square of the radius of gyration of the portion with respect to the neutral axis and the distance of the centroid of that portion from the same axis. Hence, (also see Fig. 4),

$$a_t = k_1^2/x_1 + r\cos\theta\,.$$

And since the resultants C_c and C_s are practically equally distant from the neutral axis, the arms of $C_c + C_s$ and C_s are practically equal; that is, approximately,

$$a_c = k_2^2/x_2 - r_2\cos\theta\,.$$

If now these values of a_t and a_c and those for C_c, C_s and T_s be substituted in Eq. 2, it will reduce to

$$(1 - \theta/\pi)\,\frac{x_2}{r}\,(1 + n\,p)\left(\frac{k_2^2}{x_2\,r} - \cos\theta\right) + (\theta/\pi)\,\frac{x_1}{r}\,n\,p\left(\frac{k_1^2}{x_1\,r} + \cos\theta\right) = \frac{W}{A\,f_c}\,(1 + \cos\theta)\,\frac{e}{r} \quad \ldots(5)$$

It can be shown that

$$k_1^2 = r^2\left(1 + \frac{1}{2}\cos 2\theta - \frac{3}{4}\,\frac{\sin 2\theta}{\theta}\right)$$

and $$k_2^2 = r^2\left(1 + \frac{1}{2}\cos 2\theta + \frac{3}{4}\,\frac{\sin 2\theta}{\pi - \theta}\right)$$

Imagining these values of k_1 and k_2 substituted in Eq. 5, it will be seen that the left-hand member is a function of θ, n, and p only. Denoting this function by $F_2\,(\theta, n, p)$, the equation can be written

$$(1 + \cos\theta)\,(e/r)\;W/Af_c = F_2\,(\theta, n, p) \quad \ldots\ldots(6)$$

Division of Eq. 6 by Eq. 4 gives

$$\frac{e}{r} = \frac{F_2(\theta, n, p)}{F_1(\theta, n, p)} \quad \ldots\ldots(II)$$

Eqs. I and II are the desired modifications of Eqs. 1 and 2. If both be plotted on a θ base for a given set of values of n and p, ($n = 15$ and $p = 0.01$, say) a pair of curves results as

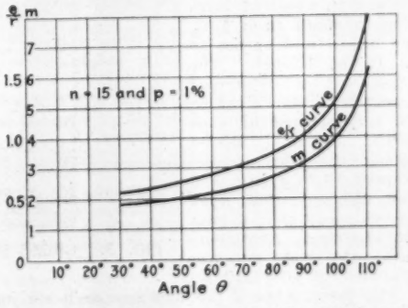


Fig. 5. A Set of the Curves Used for Plotting the Diagram Fig. 3.

sketched in Fig. 5, from which may be taken the value of m for any value of e/r.

Finally, if such simultaneous values of m and e/r (corresponding to one and the same value of θ) be taken off from this pair of curves and these values be plotted on values of e/r as base, the resulting curve is the 1% line of the diagram Fig. 3. In a similar manner the other percentage-lines can be determined.

The ratio-lines may be determined as follows: From similiar triangles in the lower part of Fig. 4, it is plain that

$$\frac{f_s}{nf_c} = \frac{r - r\cos\theta}{r + r\cos\theta} = \frac{1 - \cos\theta}{1 + \cos\theta},$$

$$\text{or } \frac{f_s}{f_c} = n\,\tan\frac{\theta}{2}.$$

From this equation it appears that for $f_s/f_c = 5$ say, and $n = 15$, $\theta = 60°$ irrespective of the value of p. Now the values of e/r for $\theta = 60°$, and $p = 0$, ½, 1, 1½, etc., may be read off from the corresponding pairs of curves (like Fig. 5), and these values of e/r may be marked off on the corresponding percentage-curves in Fig. 3; the points so marked off fix the $f_s/f_c = 5$ line. In a similar manner the other ratio-lines can be determined.

BRICK CHIMNEYS.—The methods here explained for determining wind stress in reinforced-concrete chimneys apply also to brick chimneys. For these latter, all sections should fall under Case 1. A section falling under Case 2 can be solved by means of the diagram, using the $p = o$ percentage-line.

Acknowledgment is due Messrs. S. G. Lunde, O. H. Drought, and J. G. Hirsch (graduates in Civil Engineering, class of 1908, University of Wisconsin) for the extensive computations involved in the construction of Fig. 3.

ACCIDENTS ON NEW YORK CITY STREET RAILWAYS.

During the past year the newly organized Public Service Commission of the State of New York has been requiring all the railways in the city of New York, both steam and electric, to submit monthly statements of the accidents upon their respective lines. These statements have been tabulated by the Commission and are used both as means of warning the public of the danger in a careless regard of the ordinary principles of safety and as a record for the benefit of the railways in their management. In the accompanying table this record is presented for the first seven months of the current year itemized under: (1) a classified statement of all accidents; (2) a statement of personal injuries (included in the first statement), and (3) a statement of serious injuries (also included in the first and second statements).

While this list includes accidents on the steam railways operating in terminals and yards in the city (partly under electric power), we have it on the authority of an officer of the Commission that by far the larger proportions of the accidents noted are upon the local traction lines, subway, surface and elevated. This might be inferred from the small proportion of employees to non-employees injured. From the records of the U. S. Interstate Commerce Commission it is well known that in the steam railway accidents in the entire country the greater part of those injured are employees of the companies.

TABLE SHOWING ACCIDENTS ON RAILWAYS IN NEW YORK CITY, JANUARY TO JULY, 1908.

	Jan.	Feb.	March.	April.	May.	June.	July.	Total.	Average.
Car collisions	170	203	148	138	195	167	169	1,190	170
Persons & vehicles struck by cars	934	945	905	929	1,016	1,070	1,002	6,801	971
Boarding	479	412	574	562	627	707	636	3,997	571
Alighting	416	286	454	544	772	1,252	1,305	5,029	718
Contact with electricity	34	36	27	36	43	50	49	275	39
Other accidents	1,888	2,069	2,245	2,498	2,490	2,493	2,542	16,234	2,319
Total	3,921	3,951	4,353	4,707	5,152	5,739	5,703	33,526	4,788
Injuries:—									
Passengers	1,444	1,219	1,525	1,671	2,066	2,517	2,313	12,775	1,822
Persons not passengers	570	462	632	662	694	639	620	4,279	611
Employees	486	476	474	503	622	634	645	3,840	549
Total	2,500	2,157	2,631	2,836	2,382	3,790	3,578	20,874	2,982
Serious Injuries Included in Above:—									
Killed	44	26	44	30	32	42	35	253	36
Fractured skulls	15	15	8	24	15	16	13	106	15
Amputated limbs	6	5	1	5	3	10	4	34	5
Broken limbs	32	24	33	30	41	40	54	254	36
Other serious	91	69	101	102	151	194	133	841	120
Total	188	139	187	191	242	302	239	1,488	212

A THREE-HINGED MASONRY ARCH WITH METAL JOINTS AND CONCRETE SUPERSTRUCTURE.

In the "Annales des Ponts et Chaussées," vol. 29, part 5, 1907, M. Henri Tavernier describes an arch bridge recently built across the Branla, near Lyons, France, which is rather novel in that the necessity of erecting a bridge here was

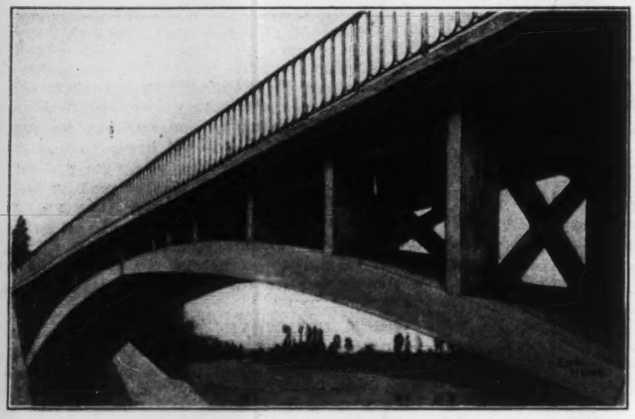


FIG. 1. A THREE-HINGED MASONRY ARCH WITH CONCRETE SUPERSTRUCTURE NEAR LYONS, FRANCE.

used as an opportunity to demonstrate several theories of construction afterward to be applied to much larger structures. The bridge is small and intended for light highway traffic so that there need have been no complicated problem in its design, but the type adopted is quite peculiar, a three-hinged masonry ribbed arch with metal joints between the voussoirs and a reinforced-concrete superstructure. For each of these peculiarities the government engineers who had charge of the construction, had reasons connected with the future construction of larger bridges and based on past experience and experiment.

It is well known that the use of hinges concentrates the line of pressure in known points, thus not only making the stresses determinate but retaining the pressure curve within smaller limits, reducing the necessary ring thickness thereby; so the use of hinges here is not particularly novel. The metal joints, however, are somewhat out of the ordinary. From a long series of experiments made by the French government, the engineers have decided that stone blocks with metal joints are measurably stronger in crushing value than stone with lime or cement mortar joints. These experiments were made on stone blocks separated by no other material, by mortars of various thicknesses and constituency and by metal, both in sheets and poured molten, and it was shown to the satisfaction of the experimenters that the molten metal joints more nearly approached the solid stone in crushing strength than any of the other joints. In the mortar joints a disintegration of the joint set in at a load much lower than the crushing point of the stone and this former load was taken as the maximum strength of the mortar joint, whereas in the metal joint the first indication of failure was found in the stone itself. In the experiments the average crushing strength of solid blocks of various stones and of the same stone jointed with, first, zinc and then cement mortar, are, respectively, 17,500, 11,900 and 3,200 lbs. per sq. in. While the last value of these three seems altogether too small, in proportion to the others, for a good cement mortar, we give it from the original article for what it is worth. As poured molten zinc seemed to give the best results of the metals, economy and strength both considered, it was adopted for the joints in the Branla Bridge.

The combination masonry and concrete construction was used because the stone, being stronger in direct compression, serves better for the arch ring and the concrete being stronger in flexure, for the superstructure. If masonry had been used for the upper works, the horizontal bracing necessary where the arch comprises two ribs would have been very difficult to design, whereas in concrete this was quite simple, with the exception of joining the spandrel columns to the arch ring, but this was successfully accomplished as shown below. Steel was thought of for the superstructure, but the extreme difficulty of joining it with the masonry and the liability of its unequal expansion from sun's rays on one side, prohibited its use.

The Branla bridge consists of two masonry three-hinged arch rings, each 82.1 ft. span and 8.2 ft. rise, spaced 8.4 apart c. to c. and connected in the plane of the extrados by a solid plate of reinforced concrete 3 ins. thick. These rings are made up of separate blocks, each about 6.8 ft. long, 2 ft. wide and varying in depth from 1 ft. at crown and spring to 2 ft. at haunch. The roadway, of reinforced concrete as shown in Fig. 3, is supported by concrete columns spaced along the ribs at distances 9.3 ft. c. to c. and so disposed that they never occur over a joint in the ring. Abutments are of solid masonry founded on pile footings.

The joint between the masonry arch rib and the connecting concrete plate was made by cutting a groove in the top inside edge of the voussoirs into which the plate was set, at the same time notching back, in dove-tail, joints in the masonry into which the reinforcement of the plate was set, being held by the concrete and by vertical fox-bolts set into the stone. Fox-bolts were also driven down into the stone, extending up into the spandrel columns to form the reinforcement. This construction is shown on Fig. 4. At the hinges the horizontal concrete connecting plate was continued down the face of the stone making a vertical connecting plate at these points. (Fig. 4.)

The pouring of the zinc joints was accomplished in one extended day's work. First the stones for the arch ring were set on the centering, tooled square on their joint faces with a point chisel and separated from each other by wooden plugs 3/16-in. in thickness. When all the stone had been set the outside of the joints were plugged with asbestos, and covered with plaster, leaving a small opening to the zinc. Into this opening the molten metal was poured from a melting pot just large enough to hold one joint. Eighteen hours were needed for the pouring of the joints. The connecting plate and the bases of the columns were then laid before the centers were struck. After the striking the remainder of the bridge was completed. In the pouring of the joints no difficulty was encountered, but had there been it would have been an easy matter to have moved the adjoining stones a trifle and slid out the solid sheet of zinc.

The loads on the bridge were assumed as 82 lbs. per sq. ft. or a concentrated 6.6-ton wagon, these loads giving a maximum compression in the arch ring of 780 lbs. per sq. in. The steel hinges only take a stress of 3,700 lbs. per sq. in. and as they are at the minimum limit of size as far as stiffness is concerned, it may be seen that a hinged structure was hardly necessary here. The same may also be said of the stresses in the stone and zinc joints, which are much lower than they could stand, but, as stated above, the construction was largely experimental to determine the practicability of this kind of construction. The cost was $2,600 or $2.40 per sq. ft. of roadway between abutment faces, but it must be remembered that this low price is based on continental labor and material figures which are much lower than in this country.

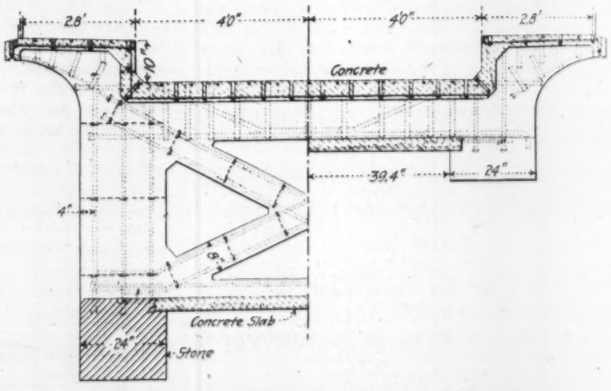


FIG. 3. CROSS-SECTION THROUGH ROADWAY OF THE BRANLA BRIDGE.

The main novel feature of the construction is the utilization of the molten zinc joints, which very successfully serve their purpose, and which the French government engineers thoroughly endorse for similar work on larger structures.

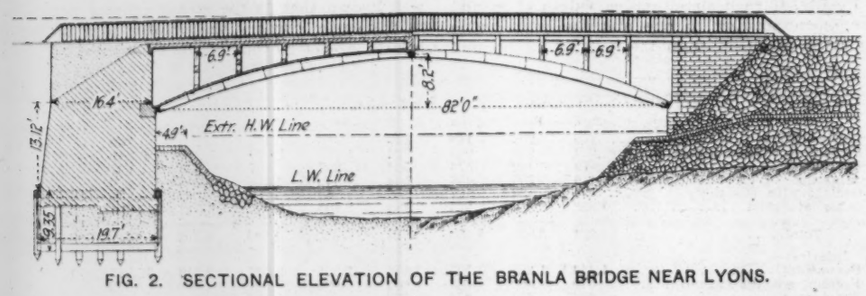


FIG. 2. SECTIONAL ELEVATION OF THE BRANLA BRIDGE NEAR LYONS.

EXPOSURE TESTS OF PAINTS.

Extensive tests of various paints and paint pigments by actual exposure to the weather have been initiated by the Paint Manufacturers' Association of the United States, partly in cooperation with the American Society for Testing Materials' Committees on Preservative Coatings for Iron and Steel and on Corrosion of Iron and Steel. The former of these two committees has already under way a very elaborate exposure test of paints for steel structures, having painted 19 panels of the new Susquehanna River Bridge of the Pennsylvania R. R. at Havre de Grace, Md., with 19 different paints, about two years ago.

For the Paint Manufacturers' exposure tests Atlantic City, N. J., and Pittsburg, Pa., were selected as giving the accelerated destructive actions of sea air and smoke-laden air on painted surfaces. At each place test fences have been or

are being built, whose faces are covered with small panels of wood or steel each painted with one of the pigments or mixtures to be tested. Careful examination of the panels at intervals of six months or a year, supplemented by photographs, will furnish the material for a qualitative valuation of the various paint materials employed. The test fences for wooden panels have already been built; the panels were painted and put on during the early months of 1908.

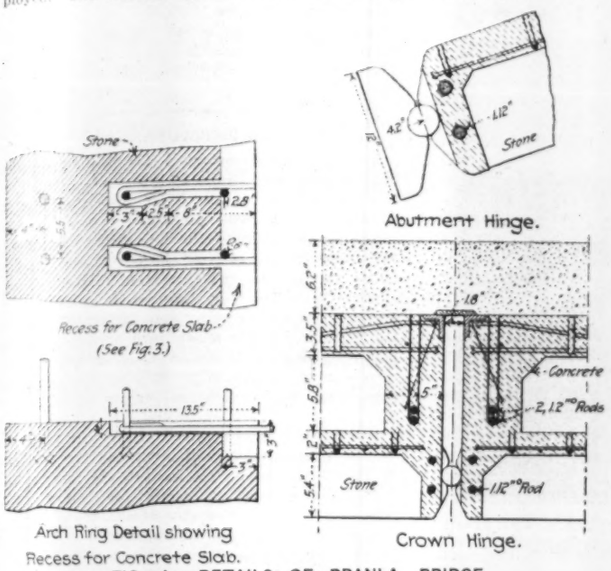


FIG. 4. DETAILS OF BRANLA BRIDGE.

WOOD PANEL TESTS.—The fence at Atlantic City (about three miles south of the city) is about 180 ft. long by 8 ft. high. It consists of 6-in. square yellow pine posts 6 ft. 4 ins. apart set 4 ft. in the ground on a concrete base, connected by 2 × 6-in. studding at the top and at a point 12 ins. from the ground, and a sheathing of plain white pine on both sides. The fence runs north and south, giving east and west exposures. The panels, which were fastened to this fence, are each 15½ ins. high by 3 ft. long, made of three strips of German weatherboarding running horizontally, blind-nailed, and capped with a horizontal drip-board projecting 1 in. in front of the surface. They were attached by round-headed screws, for easy removal. Three kinds of wood were used, white pine, yellow pine and cypress. The material was kiln-dried for 90 days, then weathered for an equal period in the lumber yard, then selected by an expert lumber classer, and finally made up into panels. These were again gone over by the lumber classer, to weed out all defective panels, and the approved panels were forwarded to the paint house near the test fence.

The painting was done in this house, as the early season made it seem likely that if painted on the fence they might be affected in varying manner by the weather conditions at the time. They were photographed both before and after painting.

The painting was done with a 7—0 round bristle brush for the first coat, and a 3-in. flat chisel brush for the second and third coats. Knots were painted over with orange shellac, in some panels before and in some after the first coat. The weight of paint applied in each coat of each panel was found by weighing the pot, paint and brush before and after painting. No attempt was made to observe a fixed spreading rate, but the painting was done as seemed appropriate to the particular material used in each case, and the actual spreading rate recorded. The first or priming coat was given 8 days to dry, the second coat 9 days.

The paints were applied in white, yellow and gray, the latter two being identical with the first except for the addition of the tinting substance. Tests of other colors were arranged only on a small number of special panels, as second coats on different white base coats, in order to determine what base is suitable for the respective colors. On some panels, to determine the actinic action of light, small plates of clear glass and of orange glass, 5 × 2½ ins. were tacked on the middle board of the panel and sealed with putty. The opacity of the paints was also tested by marking a cross on each panel with lampblack and japan, over the priming coat. The hiding power of the second and third coats, after drying, was noted by looking for this cross, and any change will be observed in the subsequent periodical inspections.

The fence has 560 panels, 280 on each side. Each is branded with a serial number and with the letter W, Y or C to denote the kind of wood.

The Pittsburg fence is similar to this. It is located on a high bluff, opposite the Women's Building of the Carnegie Institute, and runs east and west, giving exposure to north and south.

STEEL PANEL TESTS.—The test-fences for steel panels are not yet completed. They will each accommodate 300 panels, 24 × 36 ins., about ¼-in. thick. Open-hearth structural steel, Bessemer low-carbon steel, and pure ingot-iron will be the materials. Each kind of paint will be applied to four plates, two painted in condition as received or with scratch-brushed surface, and two after pickling in sulphuric acid and neutralizing with lime. Like the wooden panels they will be painted under cover, but at a uniform spreading rate. Some unpainted panels will also be placed on the fence, for comparison.

These tests are under the direction of the Scientific section of the Paint Manufacturers' Association of the United States. Mr. R. S. Perry, 3500 Grays Ferry Road, Philadelphia, is Director of the section, Mr. H. A. Gardner is chemist and Mr. J. B. Campbell is Inspector.

THE TOTAL PRODUCTION OF PETROLEUM in this country in 1907 is reported in a bulletin of the U. S. Geological Survey as amounting to 166,095,335 bbls. or 22,149,862 metric tons. This shows an increase of 39,601,399 bbls. over the production of 1906. The amount of this increase is greater than the total product of petroleum in any year up to 1889. The average price decreased from $0.731 per bbl. in 1906 to $0.723 in 1907.

THE FOREST NURSERY OF THE PENNSYLVANIA RAILROAD, NEAR MORRISVILLE, PA.*

During the present season the Pennsylvania Railroad Co. has established a forest nursery for the production of plant material required in the extensive reforestation operations which are under way. The nursery site is located on a company farm about a mile west of Morrisville station, which is directly across the Delaware River from Trenton, N. J. This location was selected because of the unusually favorable soil conditions, the long summer seasons which usually prevail, and on account of its general accessibility, there being frequent service from Morrisville and Trenton direct to the nursery by the Bristol trolley line.

The present nursery comprises about 13 acres, a portion of a farm of 70 acres, practically all of which is suited for any necessary extension of the nursery. The east half of the site has a gentle slope to the west, while the remaining portion is practically flat.

In its physical structure the soil is ideal for nursery purposes. It consists of from 2 to 4 ft. of light sandy loam, underlaid with several feet of gravelly subsoil. Such a formation not only insures the thorough drainage essential to the propagation of forest seedlings, but also results in a condition of the soil which makes it possible to work the ground very early in the spring. The area had been badly worked out, however, and despite its excellent physical condition it was lacking in fertility and gave evidence of considerable acidity. The application of 20 tons of well rotted stable manure, supplemented by the use of carefully chosen commercial fertilizers, and of 1,000 lbs. of unleached hardwood ashes to the acre, resulted in remarkably satisfactory fertility, even in the first season.

In its general arrangement the nursery is divided into broadleaf seed beds, coniferous seed beds, and transplant beds, with another portion devoted to ornamental stock. The area reserved for the broadleaf seed beds occupies a solid block of 6.43 acres at the west end of the nursery. It is made easily accessible by roads along two sides of the plot. The remaining area is divided by two roads 15 ft. wide, which cross at right angles in the center of the field, while roads of the same width extend along all four sides. From the main roads, lateral paths, 4, 6 and 8 ft. wide, break the four rectangles into blocks, while 2 and 3-ft. paths divide the blocks into beds of convenient size. The roads and large paths have been bordered with hedges which will outline the permanent blocks and serve as barriers to obstruct the sweep of the wind.

This year the broadleaf seed beds cover about five acres. In this block, 220 bu. of red oak acorns (Figs. 1 and 2), 2 bu. of pin oak, 10 bu.

*From Mr. Ivy L. Lee, of the Pennsylvania Railroad Co., Philadelphia. For earlier articles on the forestry work of this railroad, by Mr. E. A. Sterling, Forester Pennsylvania R. R. Co., see Eng. News, Aug. 29, 1907, and May 14, 1908.

Fig. 1. Acorns Ready to Cover. Fig. 2. Seedlings Eight Weeks After Planting Acorns.

FIGS. 1 AND 2. RAISING RED OAK SEEDLINGS IN THE FOREST NURSERY OF THE PENNSYLVANIA RAILROAD, NEAR MORRISVILLE, PA.

of chestnuts, 5 bu. of walnuts, and 150 lbs. of hickory nuts were planted in rows 2 ft. apart. A high percentage of germination resulted from all, with the exception of the hickory, and the block now contains 1,567,000 broadleaf seedlings, most of which will be large enough to be planted in permanent situations in the field next spring. In addition to the nut trees mentioned, there are several beds of hardy catalpa and black locust

FIG. 3. GENERAL VIEW OF PORTION OF FOREST NURSERY OF PENNSYLVANIA RAILROAD, SHOWING SCREENS OVER CONIFEROUS SEED BEDS IN FOREGROUND.

in other parts of the nursery which have produced an aggregate of 400,000 seedlings.

The transplant beds occupy about 2.5 acres, and in them 300,000 trees from one to three years old have been set out in rows 12 ins. apart and 4 ins. apart in the rows. The beds are 12 × 106 ft. in size, divided by paths 2 ft. wide, with the rows of trees running lengthwise of the beds. Part of this material consists of culled plants from the stock purchased for field planting and which had heated in transit or was otherwise unsuited to immediate use. The remainder is made up of small one-year old seedlings which will be held in the transplant rows until they are large and hardy enough to stand the more adverse conditions of the permanent site. A rather high percentage of loss is expected from some of this transplanted stock, particularly from the culled Scotch pine which was imported, but this will be obviated in the future by the local production of seedlings. A small proportion of the transplanted trees, particularly Norway spruce, was set in the beds and spaced 2 ft. apart each way, in order to induce the form development essential to the propagation of individual specimens for ornamental planting.

Although the coniferous seed beds cover only one-half acre, they require relatively much greater attention than any other portion of the nursery, and are susceptible to greatest danger of loss. The young seedlings that occupy them are very delicate during the first season, and are subject to injury by birds and fungi which destroy large numbers of the plants. These pests can be controlled only by the exercise of great care. The 120 seed beds, each 5 × 24 ft. and separated by 2-ft. paths, were planted with about 85 lbs. of coniferous seed. These will have produced, at the end of the season, nearly a half a million plants. No pains were spared to bring the ground into the best condition possible. After being twice plowed and harrowed at intervals of several weeks, it was thoroughly worked over by hand with garden rakes. The beds, when worked into final form, were elevated 4 to 6 ins. above the level of the paths separating them.

Immediately prior to seeding, each coniferous bed was given a surface dressing of a blended fertilizer composed of raw bone meal, best dissolved South Carolina rock, nitrate of soda, and muriate of potash. This mixture was applied at the rate of 2½ lbs. to the bed, was thoroughly mixed with the surface soil, and the entire bed well soaked with water. In addition, unleached wood ashes were applied, as mentioned above. One-half of the number of beds were sown broadcast and covered lightly with fine earth by means of a soil sieve, the remaining beds in drills, 4 and 6 ins. apart, running across the beds. From ⅝ to 1¼ lbs. of seed were sown per bed, the amount varying with the number of seeds per pound, and the percentage of germination for the various species used. As a last step the beds were covered with the shade screens upon the tops of which building paper had been nailed so as to form a complete covering. The building paper gave greater shade and maintained uniform moisture conditions. Its function was completed with the germination of the seeds and it was then removed.

The shade frames (Fig. 3) vary somewhat from the common lath screen generally used in nurseries, being a frame made of 1 × 3-in. Southern pine, 4 × 6-ft. size. This frame is covered with transverse strips 2 ins. wide by ⅛ in. thick, placed 2 ins. apart in order to give the half shade required by coniferous seedlings during their first season. After the seeds have germinated the screens are elevated on posts 18 ins. above the surface of the bed. Four screens are used to each bed.

A common fungus known as "damping off," which attacks the seedlings during the three or four weeks following germination, causing the stem to rot near the ground, results in the destruction of large numbers of the plants. It has been satisfactorily controlled, however, by spraying with a 1 to 500 solution of sulphuric acid, and by dusting the plants with washed sulphur and powdered charcoal during moist weather.

In order to produce the ornamental trees, shrubs and hedge plants required for planting on station grounds and along the right-of-way, a portion of the nursery is devoted to the propagation of such material. At the present time this stock forms little more than a nucleus from which larger numbers of these plants will be propagated.

Water is supplied to all parts of the nursery through a 2-in. main running through the center of the area. The distributing system consists of approximately 2,000 ft. of ¾-in. line on which 14 taps are placed at convenient intervals for hose connection. Water is pumped directly from the canal into the main by a Gould plunger pump, operated by a 2½-HP. gasoline engine. The engine will operate the pump up to 1[illegible] sure, and this head gives a spray [illegible] 40 to 50 ft. from the hoze nozzle [illegible] lines of hose in operation. In orde[illegible] for the excessive supply in the mai[illegible] is fitted with an escape valve throu[illegible] water wastes when the capacity of [illegible] greater than the amount flowing fr[illegible] connections on the line.

Deducting the loss in the transpla[illegible] nursery now contains in round nu[illegible] 2,530,000 trees of all sizes, exclusi[illegible] mental stock.

A FISH DISTRIBUTING CAR.*

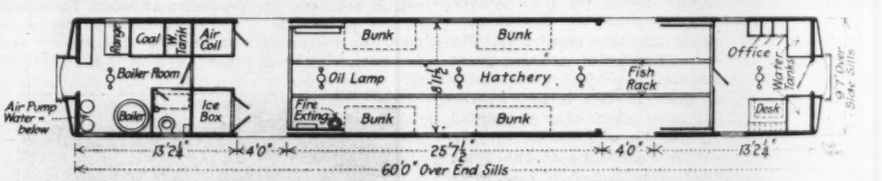
A car designed especially for fish [illegible]ribution has recently been built by the State [illegible] California for the use of the State Fish [illegible]mission. In this car, it was planned to eli[illegible]ate the changing of water in the fish tanks, [illegible]ich was necessary in the method formerly us[illegible] and to make possible the transportation of fi[illegible] through greater distances and changes of cli[illegible]tic conditions. These objects were attaine[illegible] and, at the same time, the death rate of fish [illegible]n transportation was reduced to a minimu[illegible] by the provision of apparatus for feeding into [illegible]he tanks containing fish a constant supply of [illegible]old fresh air.

The general arrangement of the car is shown in the accompanying illustration. At one end, in the "boiler room," is located the plant which furnishes the requisite supply of cold air. An 8-in. air pump, driven by steam from a 27-in. vertical boiler, forces air through a coil packed in ice, compressing it into a tank placed directly above the coil. From this storage tank the air is piped to the fish tanks in the hatchery.

Two air pumps are provided, one being held in reserve. Below the air pumps is a boiler feed pump to be used in case the injector at any time fails to work properly. Water for the boiler is carried in the tank located above the lamp in the lavatory, and an auxiliary supply is carried in the two tanks at the other end of the car, which also furnish water for filling the fish tanks in the hatchery. The pipe connections from these tanks are carried beneath the car. Steam from the boiler, besides driving the air pump, is used for heating purposes.

The pressure tank above the coil is a cylindrical shell, 3 ft. long by 28 ins. in diameter. The air in this tank is kept at a pressure of 50 lbs. per sq. in., but the pressure in the line leading to the hatchery is decreased to 15 lbs. by means of a reducing pressure valve. The air is piped to both sides of the hatchery and fed directly into the tanks containing fish.

One hundred fish tanks are carried, 50 in each side of the hatchery. These tanks hold about



FLOOR PLAN OF CAR FOR FISH DISTRIBUTION.

25 gals. each, and are of the type used in shipping milk. The car is equipped with a range, cooking utensils and all other necessities for the accommodation of a chief and three assistants.

THE SUPERIORITY OF THE MOTORCYCLE as an economical means for transporting the repairman to the seat of trouble incident to the maintenance of telephone lines has, according to "W. & M. Telephone Wire News," been fully demonstrated. As stated in their August issue:

During the greater part of the spring, summer and fall seasons it has been found that, with the motorcycle, one repair man is able to accomplish as much in one day as three men would ordinarily accomplish with three livery teams. It has been demonstrated that a repairman can travel 30 miles, clear a case of trouble and return to the starting point in less time than a man and team would be in reaching the seat of trouble. A full set of repairman's tools may be carried on the motorcycle without inconvenience to the rider.

*From information furnished by Henry V. Miller, Sacramento, Cal.

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Of the three notable high-masonry dams now being built in the West by the U. S. Reclamation Service, the Roosevelt, progress on which from its inception until the present summer is described elsewhere in this issue, was the first to be put under construction and ranks above the others in several notable features. The main dimensions of these three dams were published in tabular form on page 71 of our issue of July 16, 1908, in comparison with similar figures for the Assuan Dam on the Nile in Egypt. The maximum height of the Roosevelt Dam is but 284 ft., compared with 326 for the Shoshone and 215 for the Pathfinder; but the Roosevelt Dam will have a length over all of 1,080 ft. as against the remarkably short lengths of 175 ft. for the Shoshone and 226 ft. for the Pathfinder Dam.* The Roosevelt Dam will store 1,284,000 acre-ft. of water as against 456,000 for the Shoshone and 1,025,000 for the Pathfinder Dam. Most of the figures relating to the Assuan Dam are small compared with those given above, but its length is 6,562 ft., and it will provide 1,860,000 acre-ft. of storage. These figures for the Assuan Dam, however, apply only to the structure after its projected increase in height from 118 to 141 ft.

As will be seen from our article on the Roosevelt Dam, elsewhere in this issue, many interesting problems in the construction have been successfully met thus far, not the least of which, perhaps, has been the handling of floods which have submerged the work a number of times.

The progress that has been made on these and other American irrigation works since the passage of the enabling legislation by Congress six years ago shows the possibility of rapid, efficient government construction of public works when able men are given a free hand and when ample funds are placed at their disposal for use as needed. But notable as is this feature of the work of the U. S. Reclamation Service, it will be more than matched, as an object of interest and admiration, by the marvelous change in the face of nature and in the wealth productivity of large sections of country that will be wrought when these various great irrigation works are supplying water to hundreds of acres of land heretofore parched and arid wastes.

*Discrepancies in some of these figures as compared with those given elsewhere in this issue, in a part of our edition, will be explained next week.

Every innovation in engineering design or construction, though primarily intended to perform some useful local purpose, indirectly is an experiment to prove, for use in future work, the practical worth of a theory. But rarely indeed have full-size structures been built with the idea of testing certain novel methods and forms, such a structure, for instance, as is noted on another page of this issue in the construction of the small Branla Bridge by the French corps of Ponts et Chaussées. This bridge was not built entirely as an experiment. The necessity for a crossing at this point was made the opportunity to put to the test certain theories of design and construction which might be utilized on much larger bridges, but the results of which could equally well be observed on this smaller structure.

This is not altogether uncommon in other branches of the profession. In sanitary engineering, for instance, the unit system of construction in sewage and water purification plants, affords admirable opportunity for the installation at first of one or several units, from the behavior of which the final details of the design of the whole plant are ordered. In another field we call to mind a certain engineer who, having the opportunity in a period of five or six years to build a number of bridges in a municipality, designed every one after a different scheme, partly, no doubt, on account of the different physical problems at each site, but largely, also, to accumulate for himself and the profession data on several new phases of construction. Possibly the element of personal advantage entered too much into his motives, but the community and the profession have benefited more from his work than from that of some others who are so conservative and afraid of the novel in design that, having once settled on what might be considered a proper construction, they turn out bridges so alike in both structural composition and architectural form that the topography of the surrounding landscape is the only distinguishing feature between one bridge and another.

On account of the duty that every engineer owes his client to take few chances that may impair the safety and permanence of his work, full-size experimentation is not likely to have much vogue in private practice. The only field where it may find favor is among the engineering corps of large corporations and of the government; organization in each case which are permanent and which have in prospect such a great amount of work that the possible danger of unsuccessful experiment is outweighed by the certain utility of successful innovation. In government work, particularly, the fact that such bodies as the Ponts et Chaussées of France have the good of the whole people to work for makes it possible for them to undertake experiments of not altogether assured success because the profession and the country, as a whole, will benefit thereby. The French service, to the American mind, tends too much toward the extraordinary in construction, as the numerous freak bridges which they have built will testify; but the principle, if wisely executed, is correct, and many valuable details of design will surely result from it.

To those readers of the morning papers who have come to believe that automobiles are the most prevailing cause of accident and sudden death, we commend the monthly reports of the Public Service Commission upon the street railway accidents in New York City, a resumé of which is printed on another page of this issue. The statistics of a city of four millions must naturally run into high figures and astonishing items are apt to decrease in importance when reduced to percentages, but even considering the immense basis of railway mileage and population these accident figures are large enough for the earnest consideration of every citizen.

Every month 3,000 persons are injured, more or less seriously, on the street railways of the city of New York; of this number 35 are killed and 200 quite seriously injured. This means that 9 out of every 1,000 inhabitants of the community are annually injured on the city's traction lines, when the death-rate from all causes is only 18 per 1,000.

Much has been done in the past few years by the federal authorities to prevent the occurrence of accidents on the steam railways of the country, both in publicity campaigns and in the enforcement of safety appliances, and although no very marked reduction in casualties has been noticed, yet it is hoped that in time the effect of the work will show in increased safety. But such a campaign cannot have so potent an influence on street railway accidents from the very nature of their occurrence. Steam railway accidents are largely due to causes external to the person injured. He is a helpless object in the hands of the engineer, the switchman, the dispatcher, and even the inspector and maker of the material. All the precaution in the world will not save him from the derelict employee or faulty material. On the contrary, it will be noticed in the New York City report that over 90% of the classified accidents were due to personal actions in alighting or boarding or in being struck by cars. For these casualties incompetent workmen and imperfect material may be partially responsible, but the larger burden of safety lies with the public. Safety devices such as fenders, air-brakes, searchlights, side-bars, etc., add to the safety of city traction, but a safety appliance law or any other sort of government regulation cannot preserve life and limb on street railways to the same extent that like legislation has promoted the safe operation of the steam roads.

The Interstate Commerce Commission report for 1906 shows that of the total number of classified accidents on steam railways in that year, 40% were due to causes external to the injured party, as against 10% in the street railway system of New York during the seven months of 1908. Furthermore, of the 60% remaining accidents noted on the steam roads presumably owing to personal negligence or accident, the greater proportion could probably have been prevented by safety appliances, because they were due in a large measure to grade crossings, improper signals, overhead obstructions and the manifold other preventable causes which do not and cannot exist on a street railway line, where the safety of the passenger or pedestrian is mainly his own lookout.

A recent advocate of the growing anti-accident crusade has stated that carelessness is fast becoming the racial vice of the American. These bulletins afford good material to support his claim. The final remedy for such accidents must be found not so much in the mechanical and legal administration of the roads as in the training of the street and car using public to a greater appreciation of the dangers of hasty boarding and alighting and preoccupied passage through the streets.

The old adage, "An ounce of prevention is worth a pound of cure," is particularly applicable to the street- and road-dust problem of which so much is heard of late. Unfortunately, this is scarcely recognized as yet in the case of street pavements in American cities, as is witnessed by the reliance commonly placed on street sprinkling to keep down dust, instead of getting at the root of the matter by so cleansing the streets that the dust will be kept at a bearable minimum. Standard pavements, by their own wear and tear, do not ordinarily give rise to dust to any such degree as do the materials used in the surface of ordinary macadamized roads. It is true that the advent of the high-power and high-speed motor vehicle stirs up dust on good pavement if the latter is not properly cleaned; but these powerful machines do not by their own action contribute largely both to destroy the pavement and to make it into dust, as is the case of automobile traffic on macadamized roads.

The dustless macadam road was of course desirable before the advent of the automobile, and

attempts to provide it were made here and there. With the multiplication of motor vehicles and their increase in weight and speed, the problem of dust prevention has increased to great magnitude and at the same time has been so enlarged or added to as to include the problem of preventing the roads from going to pieces entirely. Devices to lay road dust had the objection at the outset of being mere palliatives, thus suggesting the desirability of a form of road construction that would make dust preventives unnecessary. This desirability is now being recognized as an absolute necessity, so that in the near future we may expect to see main roads, at least, constructed of an aggregate which includes sufficient cementing value to reduce disintegration and dust to the lowest possible minimum. What the best method is or may prove to be to attain this end is a fruitful subject for discussion. Presumably, much will be said on the subject, and perhaps the rather befogged atmosphere of the present day will be cleared somewhat, at the coming International Roads Congress, which will be held in Paris in October of this year.

Fortunately, we in this country are in a better position than some of the foreign countries, and particularly England, to take up the matter of dust prevention in a sane way. This is due to the fact that we have not yet become so much the victims as are our foreign, and notably our British, friends, to patented and proprietary processes and articles as a means of solving every sanitary and allied problem. In England the number of dust preventives is legion. What is needed there, and everywhere else where these proprietary processes are being pressed to the front, is a clear understanding of what the dust problem really is, and of the exact nature of the various possible means of solving it. The problem is one that appeals directly and forcibly to the many readers of Engineering News who have to do with the construction and maintenance of roads.

DO WE NEED A NATIONAL BOARD OF HEALTH?

When the two great political parties of the United States and some of the minor parties as well insert planks in their platforms favoring some innovation, it is a pretty sure sign that a popular demand for the proposed object has arisen; or if not a popular demand, then that the advocates of the change have impressed upon party leaders that the change ought to come and will prove popular as soon as understood. Two striking instances of planks which in essence are to be found in several or all the party platforms in the present presidential campaign are the demands for the conservation of the natural resources of the country and for more systematic and extensive national health-protective work. Of the two, the conservation of natural resources is the newer and has recently been presented to the country with by far the more force. The demand for national health-protective work, though less strikingly urged upon the country of late, has not only been considered in a limited way by special organizations for a considerable time, but for several years in the late '70's we actually had a National Board of Health. (For a sketch of that Board, see Eng. News, April 2, 1908, p. 373.) It would be interesting and perhaps profitable to consider the reasons that led to the creation and particularly to the death of that Board, but for the present we must confine ourselves to current issues.

The health-protective planks of the two leading parties are as follows:

FROM THE REPUBLICAN PLATFORM.

We commend the efforts designed to secure greater efficiency in National public health agencies and favor such legislation as will effect this purpose.

FROM THE DEMOCRATIC PLATFORM.

We advocate the organization of all existing National public health agencies into a National bureau of public health, with such power over sanitary conditions connected with factories, mines, tenements, child labor, and other such subjects as are properly within the jurisdiction of the Federal Government and do not interfere with the power of the States controlling public health agencies.

It is far from our purpose to discuss the political aspects of these planks. The Republican plank is so general in character that about all that can be said of it is that it recognizes the demand for further action in health matters on the part of the National Government. The Democratic plank is specific as to the desirability of consolidating existing public-health agencies into a single bureau, and as to some of the duties which should be assumed by such a bureau. At the same time, the Democratic plank is guarded in the matter of differentiating the proper fields of work to be entered upon by the Nation and by the several States. Far more specific than the other plank though it be, people who have given careful thought to the subject will not consider the Democratic plank as a very satisfactory expression of the proper work of a national bureau of public health. But while this is true, the plank does give some specific points for discussion instead of merely asserting the desirability of securing "greater efficiency in national public-health agencies." Of course the main or at least the legitimate purpose of any such plank is accomplished in most instances if it serves to fix in the national mind the importance of the principle involved and the desirability of incorporating that principle in our public policy.

Now that the question of a national board or bureau of health has been brought squarely before the country, it becomes pertinent to inquire whether such a bureau is really needed. The question cannot be intelligently answered without careful consideration of what should be the proper function of and the differences between the work of a national board of health and the boards of health of the several states. In fact, intelligent discussion of the subject would begin with a detailed study of the proper field for the work of municipal boards of health, for it is upon these that the great bulk of health-protective work must rest. With the municipal and state fields each delimited, it would become more evident, not only what remained for a national board of health to do, but also what would be the likelihood of its accomplishing the work.

For our part, we believe that a properly organized and thoroughly efficient national board of health would find a large amount of useful work to do. Just what this should be it would not be easy to say in a few words or paragraphs, especially as neither we nor any one else has yet made a careful survey of the national, state and municipal fields, the need for the study of which has been noted above. In general, of course, a national board would undertake, first of all, work that was essentially of an interstate character. But in addition there would be a large amount of educative work for it to undertake. Such work is quite as necessary and warrantable on the part of a national department as the educative work of the Department of Agriculture, much of which has to do with instruction in the methods of preventing diseases of animals and plants. In fact, one of the most telling arguments in favor of more extensive health-protective work made within the last year or two has been to the effect that the National Government was spending hundreds of thousands of dollars to obtain and disseminate information regarding the best methods of dealing with diseases of animals and plants, and not a cent for helping prevent and control the diseases of men. So sweeping an assertion is of course neither fair nor true, but still it has broad grounds upon which to rest.

An interesting subject for conjecture is the best probable composition of a national health bureau, and its proper place in the machinery of the National Government. In this discussion we have used for purposes of convenience the designation "national board of health." This term has the advantage, to those familiar with the nomenclature of government organization at Washington, of leaving the actual position of the board, in relation to other parts of the Government, an open question. The extremists go so far as to advocate a Secretary of Health, so as to give health-protective work the dignity and force of a place in the Cabinet. We think, however, that of those people who have given the matter careful consideration few would not be satisfied to see health work entrusted to a bureau in one of the departments instead of creating a new department. At present, such work as concerns the public health as is being done at Washington is distributed among several departments. This is to a degree unavoidable, as each of several departments, in carrying on some of its bureau work, would perhaps deal with public-health questions even though these were specifically invested in another bureau, or even in a department presided over by a cabinet officer. But once a board or bureau of health was created, assuming that the organic law and the organization under it were conceived and executed in the proper spirit, there would be a lopping off of various lines of work now done in different bureaus and departments because related to the work of those branches and because there was no one else to do them, and the gathering together of these scattered and uncorrelated functions into a harmonious whole. Nevertheless, it would still be necessary for a large amount of cooperative and coordinated work among the various bureaus and departments. Cooperation between separate government offices at Washington, in place of jealousy and friction, has been a very pleasing and efficient feature of government activities during the past few years, and it is reasonable to hope that it may be extended in the future. While much has been done and may be done in this way, there still remains, so far as public-health work is concerned, the need of a bureau specifically designed for that purpose.

In conclusion, now that the need for such a bureau as has been discussed is generally recognized, we may expect that the national associations devoted to public health, medicine and civic advancement will not only urge the creation of a board or bureau of health, but will also appoint committees, and at the same time constitute themselves committees of the whole, to discuss the proper functions of national, state and municipal boards of health, the degree to which these functions are being carried out, the need for reforms, and finally the best plan of organizing a national board or bureau of health and of putting it to efficient work after it has been created.

LETTERS TO THE EDITOR.

Hydraulic Concrete Roadway Pavements.

Sir: The facts collected by you in reference to hydraulic concrete roadway pavements and published in your issue of Aug. 20 seem to confirm the opinions expressed in the article contributed by me to your issue of July 21, 1904, to which you refer in your editorial.

Experience seems to be proving that for city and village streets that are not subjected to heavy travel pavements of this kind will prove to be economical and satisfactory. This favorable experience, as recorded in your article, will doubtless encourage the further trial and use of the pavement. In anticipation of this, and in order that the pavement may have a fair trial, it seems desirable that attention should be called to some fundamental principles and practices upon which, it is believed, the success of the pavement will largely depend.

Assuming that proper materials are used, the quality of any concrete structural work will depend very largely upon the proper and careful admixture and manipulation of these materials. This is well illustrated by the concrete sidewalk pavements now so largely used. When properly constructed, they have no superior; if poorly constructed, they are sure to result in disappointment and failure. Everything depends (assuming that suitable materials are used) upon the skill and care with which the work is done.

Observations and experience since the preparation of my article to which you refer seem to indicate that the general specifications therein outlined for concrete roadway pavements are sound and satisfactory. The pavement should, as in other composite pavements, consist of two courses: a foundation course to carry and transmit to the earth the loads to which it will be subjected, and a surface or wearing course, the chief function of which is to resist the abrasion of travel. The foundation course may be of good ordinary concrete, which need not be richer than 1:3:7. The stone for this course may be any good, sound stone suitable for structural concrete, or it may be gravel, or even good furnace slag, and the generally accepted specifications for such concrete may be followed. But the surface course *must* be of the best quality, compounded to secure the maximum strength and toughness, and the work of mixing and placing it *must* be done with skill and care.

As to thickness, a 4-in. foundation and a 2-in. surface course will be amply sufficient for any street where the use of a concrete pavement is at all advisable; and courses of a less thickness are hardly practicable, consistent with proper construction.

In the light of both theory and experience, the essential requisites for a successful pavement of this character may be summarized as follows:

(1) This pavement should not be used on streets of heavy travel. Without going into details, it may be confidently stated that it is not suitable for city or town streets subjected to travel of very considerable weight or volume. Its field of economic usefulness will always be confined to streets of comparatively light travel, such as those in residential districts, streets of local and limited use, and country roads. It should not be laid on boulevards or main driving arteries, even though subjected to no heavy loads, for it will be found that the element of travel most destructive to this pavement is the impact of the feet of horses. This limitation of its endurance capacity should never be overlooked.

(2) Special care must be given to the composition and construction of the surface course. The aggregate must be of the hardest and toughest material. The best quality of trap rock approaches the available ideal for the crushed stone. It should be of such assorted sizes as to secure a mass with low voids, and care must be exercised to keep the percentage of voids comparatively uniform. This does not mean that the different sizes must be separated and remixed according to any fixed formula, which is usually unnecessary, or at least not of sufficient importance to justify the additional expense involved, but merely that more than ordinary care shall be devoted to securing a mass of low and uniform voids, conditions which usually vary with the character of the stone and the manner in which it is crushed and screened. Fragments that will not pass a 1¼-in. screen should be rejected. It is best to screen out the "dust," not because it is not as good as sand, but because in handling the crushed stone this fine material is likely to become segregated and thus interfere with the uniformity of the mixture. The sand should be clean, sharp and quite coarse. With New Jersey trap rock screened over a ¼-in. mesh screen, a surface mixture of 1:2:4 will, in most cases, give satisfactory results. It goes without saying that the Portland cement should be of the best quality and should be carefully inspected.

The character and quality of the crushed stone for this surface course is regarded as very important. Ordinary limestone is too soft, and unless something better is available the use of the pavement is not recommended. Quartz gravel properly graded to give low voids, could doubtless be used where satisfactory stone is not available.

(3) It is important that perfect adhesion should be secured between the foundation and surface courses. This can only be accomplished by placing and ramming the surface course on the foundation before the latter has begun to set.

(4) The surface course should be very thoroughly rammed to make it as dense as possible, and to bring it to the true grade. Rolling with a 2½-ton asphalt roller before setting begins would further compact it and give a truer surface, but is not essential. The surface should be left as rammed; additional mortar and troweling of the surface should be avoided.

(5) The mass of completed concrete must be kept thoroughly damp during the whole time required for setting. If thus kept damp, protection from the sun by a cover of sand will not be necessary.

(6) The street must not be opened to travel until the setting of the concrete in both courses is practically completed. It will usually be difficult to enforce this requirement, but it must be insisted upon.

(7) Transverse expansion joints should be provided at distances of about 30 ft. apart, running entirely across the street. Unless the width of roadway exceeds 50 ft., longitudinal expansion joints will not be necessary except against the curb, where a ½-in. joint should be provided. Expansion joints should extend through both courses of concrete. They are best formed by using a thin iron plate set on edge at the proper places, but special care must be taken in placing and ramming the concrete against these plates, particularly the surface course. The plates should be withdrawn as soon as the concrete has begun to set and the exposed edges troweled to compact them and to slightly round the corners. Before the street is opened to travel these expansion joints should be poured full of bituminous paving cement of the proper consistency.

On streets of ordinary gradients, the practice of grooving the surface course to increase the foothold of horses is unnecessary and inadvisable. Each such groove forms a line of weakness and a starting point for disintegration. If the surface of the pavement is not troweled with fine mortar, it will give a better foothold than either sheet-asphalt or creosoted wood blocks, and will not be much more slippery than first-class macadam.

While the writer has no desire to discourage valuable patented improvements, it seems proper to say that the art of constructing good concrete is not new or patentable. Patents claiming to cover the construction of hydraulic concrete are usually valid only as to details of little value or importance, and none of those known to the writer, relating to concrete pavements, will, if complied with, result in work materially better or cheaper than the plain construction outlined above, which infringes on no valid patents. At the same time, it is conceded that in so far as patent claims may tend to restrict competition to skilled and responsible contractors, without unduly increasing the cost, they are to be regarded as beneficial. For the most serious danger to the utility and reputation of concrete pavements is to be looked for in the work of that class of contractors, who, without the proper knowledge, skill, and responsibility, take the work at inadequate prices and then skimp their work to get even. These pavements belong to the classes of work that will not bear skimping. Experience will prove that concrete roadway pavements are like the little girl, who, "when she was good, she was very good, but when she was bad, she was horrid."

If properly developed along the safe and conservative lines here outlined there is reason to believe that this pavement will satisfactorily fill the wide gap that now exists between the macadam road and the recognized high-class and expensive street pavements.

S. Whinery.

95 Liberty St., New York City, Aug. 27, 1908.

Concrete Pavement in the City of Panama.

Sir: Referring to the article on concrete pavements in your issue of Aug. 20, it may be of interest to add another city to the list of those having streets so paved.

In the city of Panama over two miles of streets were paved with concrete in 1906 and 1907, while I was resident engineer in charge of municipal improvements there for the Isthmian Canal Commission. It was originally planned to pave with brick throughout the city, but subsequently it was decided that this was unnecessarily expensive for the lighter traffic streets, and after trial on an experimental block we adopted concrete for all

Concrete Pavement in the City of Panama.

streets, outside the main business district and the principal highways.

Concrete pavements were laid between curbs of the same material, with a similar cross-section to that adopted for the brick, with a crown varying from 4 to 6 ins., according to width, which ranged from 13 to 20 ft. in most cases. Sub-grade between curbs was shaped parallel to the finished surface and on all fills was rolled.

Concrete 5 ins. thick was placed in alternate sections about 10 ft. in length along the curb, and to the entire or half width of the street, according to circumstances, between templet boards set to grade. The concrete was mixed 1 : 2½ : 5 by volume, rather wet, and tamped in place until the surface was well flushed, when it was finished with a trowel and a straight-edge drawn over the templets, giving a smooth but not slippery surface when hard. After the concrete had set the templets were removed and intervening sections completed. Concrete was hand mixed and placed from wheelbarrows.

We used Atlas cement and Panama beach sand. The latter was not of first-class quality, but it was all that was available. Stone was supplied by running the old cobbles, which formerly paved the streets, through a portable crusher set up in one of the public squares. Run of crusher was used without screening.

On account of the uniform tropical temperature expansion joints were not required.

After a year's service the pavements were in first-class shape, showing little evidence of wear. The surface was less slippery than that of the brick-paved streets, and no difficulty was experienced in its use by all classes of traffic. This traffic, while in general composed of vehicles of a lighter character than are in use in American cities of the same class (30,000 population), was probably of an equal intensity, due to the narrower streets.

The grades on concrete streets varied from nearly level up to as high as 8% in one instance. On the heavy grades the concrete gave better satisfaction than brick. In all there were laid in the built-up portion of the city 20,000 sq. yds. of concrete and 65,000 sq. yds. of vitrified brick.

The cost of the concrete was about $2 per sq. yd., as against over $4 per sq. yd. for the brick.

I enclose a view of a typical concrete street. It will be noticed that no attempt was made to pave to the old irregular curb lines. New uniform grades were adopted and curb lines placed to give more sidewalk room, while leaving a street sufficiently wide for the traffic on it. After the new pavement was completed householders were required by city ordinance to grade to the new curb and construct cement walks.

Very truly,

H. W. Durham,
Engineer, Cape Cod Canal.

Sandwich, Mass., Aug. 22, 1908.

Development in Railway Track Design.

Sir: Under the heading "Development in Railway Track Design" in your issue of Aug. 20, 1908, you say: "An important point for consideration in new track design is the fact that the present construction is inherently weak in carrying the rails on individual supports which have no uniformity of bearing on the foundation." After some discussion of this point you proceed to name systems of longitudinal track support proposed by two engineers. You note the experimental use of one design only, and state on authority of another engineer that "the vertical movement of this track under slow freight trains is greater than that of the parallel track under fast passenger trains. This was taken to indicate that the track does not provide sufficient bearing surface on the ballast and that the longitudinals have inadequate vertical stiffness for distributing the concentrated loads over a sufficient length of track."

You state that the engineer reporting admitted "that the design might be so improved as to obviate these particular objections." After some discussion of proposed concrete track supports you sum up as follows: "A survey of what has been done in designing or experimenting with new types of track construction affords little encouragement for the improvement of railway track by any radical change in design."

Why this doleful conclusion? By what system of reasoning do you reach the point where you are ready to consign to the tomb this flower just in the bud, this possibility that engineering skill may be exercised in the building of railway track? Is it because you believe that no rational or practical suggestions have been made by the many eminent engineers who have devoted some time to a discussion of the subject during the past few years? The files of the Engineering News prove the contrary, for you have carefully, cheerfully and perhaps hopefully published many articles detailing various suggestions and experiments along this line. In your editorials you have pointed out evident defects in various designs, praised advances in details, and urged adoption of sound principles of construction.

I believe the real reason for your present attitude on this subject is to be found in the editorial in the issue of June 18, 1908, "Concerning American Railway Management," in which you quote an eminent engineer to this effect: "Railway officers are so occupied with their regular work of administration that they have practically no time to give to the examination and adoption of new improvements and particularly anything which it requires some effort to understand."

As a reader of Engineering News for nearly 20 years I wish to say that the editorial last referred to was one of the most important ever printed in any journal. A study of the facts presented and heed to the danger signals therein pointed out would lead to the greatest possible benefits to the railway managers and stockholders, and therefore to the public.

So I wish to raise my voice in praise of your editorial of June 18, and in protest against your pessimistic conclusion in the article on railway track development. I think it is your high privilege and your duty to point out to the railway stockholders and higher executive officers that they should see to it that the funds are provided for and competent men assigned to the actual trial and careful observation of devices promising improvements in railways.

Improvement of the track is certainly one of the most important, but how much money have the railways spent in an intelligent way to sift the various suggestions made and determine the value of any of them by practical test under constant and intelligent supervision? They have probably spent the greatest amount on rails, but they have spent more money in traveling expenses and wages of employees and general officers attending conventions and committee meetings than they have spent in actual trial of improved rail sections under intelligent supervision. I will grant that they have spent their money on various methods of treatment of timber to prevent decay and that they have made substantial gains along this line. But in the matter of finding a

substitute for wood ties or designing a metallic or concrete track structure which will be an improvement, their intelligent expenditure has been almost nothing.

The United States Steel Corporation has expended large sums in the development of a steel cross-tie, and can present information in regard to its service for many years. But its audience is asleep. Various small corporations and individuals have started in hopefully to spend their time and money in an effort to interest the railways in devices meritorious in themselves or in combination with others a distinct improvement. The only result is that they have to listen for years to the snore of the sleeper, the gradually weakening promises of the grafter, or the senseless chatter of the know-it-all, until they have wearied of the chase.

Now why do not the railways appropriate a sum of money to be expended in purchasing and trying out various forms of steel ties and steel or concrete supports under intelligent supervision of competent men? Do you not think they would get more for their money than they do listening to papers presented at committee meetings and conventions covering suggestions or theoretical discussions only? Very truly yours,

Samuel E. Duff,
Consulting Engineer.

Empire Building, Pittsburg, Pa., Aug. 29, 1908.

[Our discussion of developments in track design related to practical conditions of the present time and a measurably distant future, rather than to remote possibilities. After more than 70 years of experience with the present type of track, this type remains universal. No new type has been developed to such an extent as to be a practical consideration, nor does there appear to be any probability of such a development. Experimental work is, of course, excepted in this statement. There is, however, plenty of room for improvement in the details of the present type, and such improvement is desirable for both economy and safety. This we have already pointed out.

As to practical experiments and technical discussions, there is no doubt that money might well be spent on the former. But the attendance of railway officers at the meetings of technical associations is without doubt fully warranted by the beneficial results of interchange of opinions and information as to both practical and theoretical matters.—Ed.]

The Proposed Membership Amendments to Constitution of the American Society of Civil Engineers.

Sir: The ballot for voting upon the proposed amendments to the Constitution of the American Society of Civil Engineers has been sent out, and the question of the wisdom of adopting the revolutionary change proposed in the methods of admitting applicants to the grades of Member and Associate Member is now squarely before the membership.

The intent and effect of these amendments is to transfer the election of applicants to these classes from the corporate membership to the Board of Directors. Such a fundamental change in the past policy and practice of the society should not be adopted without the most careful consideration.

The matter does not seem to have been fully discussed at the last annual convention, at which only about 10% of the corporate membership was in attendance, and the only available channel of discussion now must be through the technical papers, which reach a very large majority of the membership of the society. This is my excuse for asking for space in Engineering News to call attention to some of the reasons why these amendments should be rejected.

The method of electing corporate members that has so far prevailed in the history of the society is well known. The final action upon any applicant has always been determined by a direct vote of the corporate members, a certain number of negative votes (twenty or more at present) excluding the applicant. The good and bad points of this method of admitting members have been long discussed and need not be reviewed here. That it does sometimes result in the exclusion of applicants who are eligible and worthy is undoubtedly true. That it has been effective in excluding a much larger number of applicants who were unworthy and who might otherwise have been admitted is equally true. That it has helped materially to maintain the very high standard of personal honor and professional standing for which the society is noted cannot be doubted. The fact that it has occasionally enabled a few corporate members actuated by unworthy motives to prevent the admission of persons who have every qualification necessary is to be greatly deplored and should be prevented if possible. But it is of far more importance to the profession, the public and the society that high standards of membership shall be maintained than that there may be an occasional miscarriage of justice to worthy individuals.

The right of a small minority to reject applicants for membership is not peculiar to the American Society of Civil Engineers. It prevails in a large number of other organizations where it is considered important to maintain high standards of membership. It is sometimes, but not often abused. On the whole, it has been found salutary and wise. In the case of this society it may be safely asserted that it has resulted in the exclusion of ten unworthy persons where it has unjustly excluded one who was worthy. In theory, it is based upon the assumption that a few persons may have knowledge of facts and circumstances affecting the character of the applicant which it would be neither wise for them nor beneficial to the applicant to disclose, even in a confidential way. The secret negative ballot may, in such cases, save the organization from serious mistakes, and may be best for all parties concerned.

The proposed amendments recognize this fact by providing that the votes of a small minority of the Board shall reject. It is simply proposed to transfer the right of judgment from the membership at large to the Board of Directors.

The Board now passes judgment upon each applicant after all the information elicited by the "blue list" has been placed before it. The proposal is to make this judgment final, the only difference being that the whole board must vote by ballot and that three negative votes shall exclude the applicant.

In all the numerous cases of rejection by the secret membership ballot the applicant has been favorably passed upon by the Board, in most cases, doubtless, by the unanimous vote of those present at the meeting. But the application was finally defeated, wisely and fortunately in most cases by the membership ballot. This does not reflect on the care or good judgment of the board. Complete information had not been laid before it, and in the absence of this, the decision could not well have been other than it was.

The Board of Directors, as now chosen from geographical districts, labors under a serious disadvantage in dealing with important matters like this. Many of its members are seldom, and not infrequently never, able to attend the board meetings. There are now 29 members, and usually not more than half that number attend the meetings. The constant absentees cannot keep in close touch with the details of management. Reports and correspondence, however full, cannot take the place of personal conference and discussion, particularly in such delicate and confidential matters as the canvass of the personal and professional character of applicants, where publicity might do the applicant greater injustice than secret rejection. Under such conditions, while the Board might be safely counted upon to do what seemed best in the light of its information, frequent serious mistakes might be expected, which, under the present system, are finally prevented by the secret ballots of the membership.

Besides, it is not certain that the proposed plan would always prevent the evil which it is intended to remedy. It is at least conceivable that as many as three members of so large a board, might, with the best intentions, be influenced to reject an applicant on the false or one-sided representations of the applicant's enemies.

Experience seems to show that it is hopeless to depend upon replies to the blue-list to draw out all the information that may be necessary to form a correct judgment of the fitness of an applicant. Facts that are crucial may be withheld from the board, by those possessing them, for perfectly valid reasons. These reasons may be of such a character that they may be expressed safely and wisely only through the secret ballot. The assurance of the board that communications affecting the character of applicants shall be regarded as confidential is, of course, sincere and is no doubt complied with as far as possible. But the average man has little confidence in the possibility of maintaining strict secrecy regarding statements that must in the necessary course of business be laid before more than thirty individuals.

The members of the Board who are now able and willing to give their time to it are already overburdened with the work of the society. They are painstaking and conscientious and if these amendments are adopted, they will feel keenly the additional work and responsibility involved, and will doubtless feel it necessary to organize and carry out a much more rigorous system of inquiry into the character and standing of candidates for corporate membership, than heretofore. But what can they do? If they had the facilities and powers of the Inquisition they might be unable to get essential facts or to accomplish the same practical results as twenty secret negative votes.

It is not likely that any method that may be adopted for the admission of applicants will prevent occasional injustice to worthy men, and it is doubtful if any radical change in the present plan can be devised that will remedy its defects, while at the same time safeguarding the society against the admission of undesirable persons. If, with the present large membership, twenty negative votes are considered too small a number to exclude, that number can be increased, thus making it more difficult for a few members actuated by improper motives to prevent the admission of meritorious applicants.

Such a modification of the present method would be, in the opinion of the writer, decidedly preferable to the radical change proposed by these amendments.

New York, Sept. 1, 1908. S. Whinery.

Notes and Queries.

In the article by Mr. Boris Levitt on "Surveys for the Location of the Catskill Aqueduct—Rondout Creek to Kensico Division," in our issue of Sept. 3, 1908, p. [illegible], several lines in the fourth paragraph in the last column of page 248, were interchanged so that the paragraph is somewhat unintelligible. The correct reading should be:

As a check on the instrumentman the recorder was required to check the reading of the azimuth of the forward course by adding the horizontal angle, already obtained, to the back azimuth of the preceding course, to see that the differences between the readings of the middle and extreme stadia wires were nearly equal as proof that no error was made in reading the distance.

The remarkable railway accident noted on page [illegible] of our issue of Aug. 13, in which a freight train lost one of its intermediate cars without the knowledge of the train crew, was questioned by a correspondent, who called it impossible. We referred the matter to Mr. F. R. Moulton, Superintendent, C. & N. W. Ry., Huron, S. D., who gives a fuller description in the following. It will be seen that our original account was in error in one or two points, and the accident becomes slightly more understandable, though it remains a very remarkable occurrence:

An air-hose burst between the way car and the flat car next to it. The car that was derailed was the second car from the engine. When the air-hose burst the train, of course, was brought to a very sudden stop, moving, perhaps, ten or twelve car lengths. The engine and one car parted from the train and ran about eight or ten car lengths before stopping. The head brakeman went back to the rear end of the car that was with the engine and found the draft rigging and air-hose intact, then walked back in the middle of the track to the head end of the train and found nothing in the middle of the track. He also found draft-rigging and air-hose of the head end of the head car in the train intact. He then gave the signal to back up, the train was coupled up, air tested, and the train proceeded. After getting to Highmore the conductor discovered that he was short a car and found that the second car from the engine was missing. Upon investigation there were no marks to be found on any of the cars in the train to indicate that there had been a derailment, neither was there any damage done to the track where the car was derailed, the car lying about 14 ft. from the main track.

The derailment was caused, in my opinion, by the draft-iron pulling out when the air-hose burst, dropping into the middle of the track, coming up under the train and dropping the car out of the train. The rear end of the train passed along about eight or ten car lengths beyond where the car was derailed. It was a very dark night, and that is no doubt the reason why the trainmen did not notice the car.

THE INTERIOR TEMPERATURE OF LARGE BODIES OF MASONRY.

In the discussion of a paper* read by Mr. Charles S. Gowen, M. Am. Soc. C. E., before the American Society of Civil Engineers, Mr. Thaddeus Merriman, Assoc. M. Am. Soc. C. E., has presented† the results of some experimental investigations into the temperature in the interior of large masses of masonry, which, though not very comprehensive, are interesting in their novelty. The experiments were made from 1903-06 on the Boonton Dam, near Boonton, N. J., readings being taken on eleven thermophones, placed in the masonry during construction and read continuously through the progress of the work and for about a year thereafter.

The Boonton Dam is mostly of cyclopean masonry composed of about equal parts 1:3:6 concrete and large stones. It is about 3,100 ft. long, 2,150 ft. of which is masonry, with a maximum height of 114 ft., an average height of 90 ft. and an average bottom thickness of 55 ft. The thermophones were placed in various planes, the largest number at one plane being three about 10 ft. above the bottom and five about 40 ft. above the footing, and distributed equally through the section so that readings could be obtained for various distances from the faces. Owing to trouble with the coil insulation, which disintegrated in the concrete, the readings on a number of the instruments showed unaccountable fluctuations and, in some cases, the thermophones ceased recording, so that the results attained are not as valuable, intrinsically, as future similar tests will prove, now that the lessons of this first test are available.

*The Effect of Temperature Changes on Masonry; by Charles S. Gowen, Proceedings, Am. Soc. C. E., April, 1908, p. 316.

†Proceedings, Am. Soc. C. E., August, 1908, p. 829.

In the original paper Mr. Merriman gives the curves of the thermophone readings and of the atmospheric temperature, but as these are somewhat variable, we will give here only his general deductions from the experiment, which read as follows:

(1) About 12 months must elapse after the placing of masonry in the cross-section of a dam comparable with that at Boonton before the heat generated by the chemical changes incident to the setting of the cement becomes lost to an extent sufficient to render its existence a negligible quantity.

(2) After the expiration of 12 months, minimum and maximum temperatures near the center of the masonry are reached approximately 30 days after the occurrence, respectively, of the seasonal atmospheric minimum and maximum.

(3) The range in temperature at any point in the interior of a masonry dam, due to external temperature changes, is dependent on the exterior atmospheric temperature range, and on the distance of the point from the face of the dam. For distances up to 20 ft. and perhaps for greater ones, the interior range varies inversely nearly as the cube root of the distance from the face.

(4) Immediately after concrete and mortar are placed in a dam, the temperature of their mass rises and probably reaches a maximum in about 18 hours after the placing. This maximum is about 100° F. for cyclopean masonry.

(5) It may be inferred that the constituents of the mortar and concrete assume their final form and shape at the time when their maximum temperature is reached. This being the case, it would appear that nearly all portions of a masonry dam are under a tensile stress, practically from the time the materials composing it are placed in their position, and, consequently, it seems to follow that the stress producing range in temperature is more nearly equal for all portions of the structure, except those very close to the exterior of the mass than has hitherto been supposed. This deduction follows from the consideration that, if the maximum temperature attained is 100° F., then the stress producing range is the difference between 100° F. and the lowest temperature subsequently attained.

(6) Approximate computations indicate that the ultimate tensile strength of the mass of a masonry dam constructed of Portland cement is not far from 700 lbs. per sq. in.

(7) From the evidence at hand, it would seem that the use of a slow-setting cement would tend to keep down the setting temperature, and, therefore, it might be expected that a structure made of such a cement would show less cracking than one made of a cement which takes its set more rapidly.

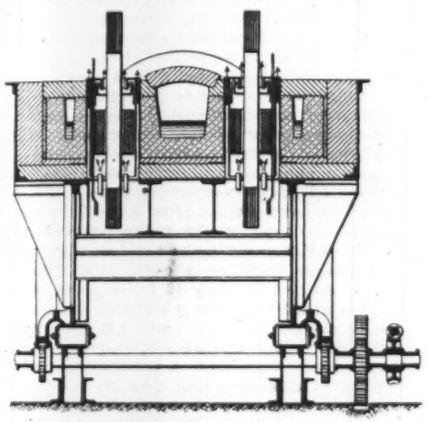
The value for temperature variation, according to distance from the face was arrived at by plotting, from the thermophone readings, the total range in degrees upon the distance of the instrument from the face. This gave a hyperbolic curve which approximately follows the equation

$$R = \frac{135}{3\sqrt[3]{D}}$$

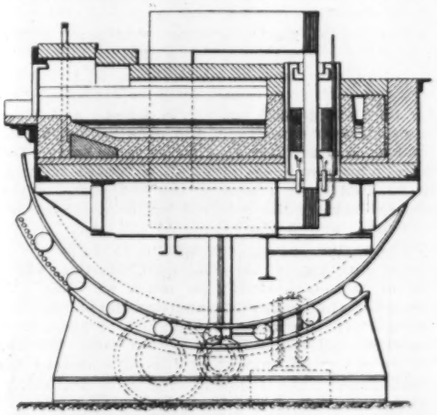
where R is the total range of temperature, Fahrenheit, at any point in the mass, and is the distance in feet to the nearest face of the dam. This is based on a total atmospheric range of 135°F, from — 18° to + 117°, and will not hold at low ranges of temperature. The author, therefore, states that the formula should not be considered as holding true for distances from the face of the masonry of more than 20 ft. or less than 0.5 ft.

A THREE-PHASE ELECTRIC INDUCTION FURNACE.

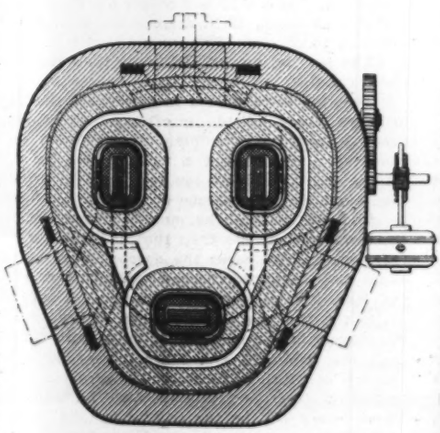
An electric furnace of the induction type, but using three-phase instead of single-phase current, is in operation at the Röchling iron and steel works at Völklingen, Germany. Prof. B. Neumann describes this furnace and its operation in "Stahl und Eisen" of Aug. 12, 1908. He declares it to be successful in every way, with the important advantage over other induction furnaces of a relatively large hearth. Rail steel has been made in this furnace, as well as soft steel for castings, alloy steel (such as chrome steel), etc. Over 1,000 tons of steel rails from this furnace are already in use on railways of Prussia.



Cross Section.



Longitudinal Section.



Sectional Plan.

PLAN AND SECTIONS OF ROECHLING-RODENHAUSER THREE-PHASE FURNACE FOR 1½-TON CHARGE; 50-CYCLE CURRENT.

The plan and sections herewith, reproduced from the article noted, show the construction of this furnace. Three laminated magnet-cores pass vertically through the hearth, which latter is of a roughly triangular ground-plan, the cores being in the angles. At both top and bottom the cores are connected by U-shaped yokes. Each core bears a winding carrying one of the three phases, and in addition has a small secondary winding which furnishes current for auxiliary heating by direct resistance. The furnace lining being carried up around the magnets, the hearth is divided into a three-branched central portion and three narrow channels passing around the outside of the three legs of the magnetic system. The liquid charge thus constitutes a system of three circuits with common return, which makes it a star-connected secondary system short-circuited through its own resistance, each loop of the secondary consisting of a single turn.

The hearth has three doors, one in each of the straight sides of the triangle, between two adjoining magnet legs. One of these is used for tapping out the charge; the furnace is mounted on a circular roller bed for tipping to discharge through this front door. Charging the furnace and drawing off slag is done preferably through one of the rear doors. The hearth is covered with firebrick arches.

Adjacent to each door and embedded in the furnace wall is a pole plate or resistance electrode, connected with one lead of the secondary winding of one of the magnet legs. The three other leads of the three secondaries are joined to a neutral connector fixed near the lower magnet yoke. The current from the three electrodes passes into the bath through the furnace lining, which is a fairly good conductor when hot.

A feature of the operation of this furnace which is claimed as a special merit is the active circulation of the bath, a result of the rotary magnetic field. Rapid and thorough mixing of the constituents of the product is claimed to be obtained through this action.

The furnace at Völklingen, which is made the specific object of Prof. Neumann's article, is operated on Bessemer steel, taking its material as the converter turns it out, and serving to refine, alloy, or otherwise treat this material. The ordinary course of treatment is to charge molten pig-iron first, for the purpose of heating up the furnace; then charge the converter steel, adding quick-lime with ore or mill-scale as a dephosphorizing flux, which is drawn off after an hour, and finally, for high-carbon steel, add the necessary amount of carbon, ferro-silicon to deoxidize, and lime to form a desulphurizing slag. To produce alloy steel, the desired high-percentage additions are made before tapping, the induction heating being continued for a few minutes to distribute the added ingredients uniformly through the bath.

DEPTH OF WATER IN IRRIGATION CANALS.

By C. E. GRUNSKY,* M. Am. Soc. C. E.

The following comments on types of irrigation canals and related matters, in substantially the form in which here presented, were originally submitted to the U. S. Reclamation Service. The fact that some of the engineers of the Service had given expression in executed and projected irrigation works to their preference for the deep, narrow type of canal was the occasion for taking up this subject by the writer, while himself still in the Service as Consulting Engineer. The point which is herein made, that a broad relatively shallow canal is preferable to the deep, narrow canal, is one that will without doubt appeal to canal superintendents, who know that the canal system is safe so long as the water surface in canal and ditches lies below, at or but little above, the natural surface of the ground, and who also know that this condition is more apt to obtain when a canal is shallow than when it is deep. Cost of operation and reliability of service should always be taken into account in the design of the canal, not first cost alone.

Canals when seasoned by long use ordinarily have steep bank slopes, often as steep as 1 to 1 or even ½ to 1. This fact is responsible for many mistakes in prescribing bank slopes for new canals. Material freshly cut or freshly excavated and placed in a canal bank in our dry western country is usually such that it will absorb moisture readily, become soft and break down under the action of even the minor water ripples that occur on every canal. Better material for facing water slopes of canal banks than the canal excavation affords is rarely available. The use of special material throughout an entire canal length, moreover, in most cases, would be inexpedient on account of cost. All that can be done under ordinary conditions is to build the canal and fill it with water. Then the points will soon become apparent at which special bank protection is necessary to make the

*Consulting Engineer, 45 Broadway, New York City.

canal serviceable. Every canal should be so planned that this special protection work will be reduced to a minimum and that the integrity of the work will not be menaced too seriously if there be some bank caving due to the undermining action of the water.

It is, nevertheless, fair to start out with the broad proposition that the slopes of canal banks should be as steep as the character of the material will justify, because the amount of material required to build the canal banks will thereby be kept at a minimum. But what is steep for one class of material is not so for another.

Certain soils will stand well in new canal banks on slopes of 1½ to 1. This is a steeper slope than ordinarily allowable, and soils will be comparatively rare on the irrigation work of the west that will make good canal bank at this slope. The majority of the light sandy and gravelly soils and the alkaline soils that are encountered so frequently in the regions where irrigation is most needed will break down at the water's edge on any ordinary canal bank slope. This breaking down is rarely attributable to the current of the water. It is usually the result of the wind ripples which eat into the bank, flattening the slope below the water surface and undercutting the bank above the water surface. The dropping of the undercut bank is a factor in producing the flatter slope under water.

Other conditions being the same, there will be more bank caving and the caving will sooner encroach on the embankment or levee crest along a bank with steep slopes than along one with flat slopes. To avoid caving back to levee crest it is therefore always desirable, in material that yields readily to water in motion, to make the bank slope flatter than the angle of repose. No rule can be laid down for this, but it is a wise precaution to make slopes of canal banks, when in fill in ordinary and doubtful material, not steeper than 2 horizontal to 1 vertical. This slope will be so nearly standard for canals on flat ground (not hillside) that in the further discussions of economic canal section this slope is the one assumed for excavation as well as for fill.

The velocity at which water may be allowed to flow in canals without eroding the bottom and banks fixes the area of the required waterway when there is no occasion for economizing fall. This condition prevails in the case of nearly all canal laterals and in the case of those main canals whose territory commanded is increased but little by using light gradients and minimum velocities.

The velocity that should be assumed as allowable must be determined by the engineer on the best information obtainable. It will usually lie between 2 and 3 ft. per sec. and may for ordinary conditions be assumed at 2.5 ft. per sec.; unless, indeed, the character of the material into which the canal is to be cut will resist erosion, in which case, fall being available, much higher velocities may be prescribed. High velocity when permissible is always desirable because there will then be no silting up of the canal.

For the purpose of comparing canals according to their cross-sectional dimensions, in the following discussion, a mean cross-sectional velocity of 2.5 ft. per sec. has been assumed, unless otherwise stated. The results would be the same if any other velocity had been introduced into the calculation.

Among the advantages of the shallow canals over deep canals is the smaller super-elevation of the water surface above the ground surface. In reference to this point it is to be stated that breaks of canal banks will be greatest on the canals whose levees are highest—all conditions relating to levee dimensions, safety margin and the like being assumed the same. The canal that carries its water at or below the ground surface (in flat country) will be free from the danger of bank breaks.

The damage resulting from breaches in canal banks and the cost of repairing such breaches is an element of the cost of canal maintenance. It is self-evident that such breaches in canal levees will occur most frequently where the water surface is highest above the ground. This frequency may be considered proportional to the super-elevation of the water surface. Furthermore, the destruction resulting from a breach will be greatest where this super-elevation is greatest. When this is only a few inches it will take the water long to make a serious break or to discharge much water across country. When it amounts to several feet the breach widens rapidly and the full volume of the canal flow, increased by the storage in the canal above the ground surface, is drawn toward the breach and may cause serious damage to crops and other property, besides throwing the canal in whole or in part out of service for a time, and rendering expensive repairs necessary. But even when such accidents are well guarded against, and are prevented by vigilance, this necessary

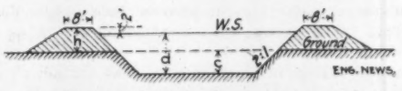


Fig. 1. Assumed Canal Cross-Section for Comparing Costs of Deep and Shallow Irrigation Canals.

vigilance is a source of expense, increasing with the danger, and therefore greatest for the canal with greatest super-elevation of water surface.

Much weight should be given to this consideration, particularly in soils and localities that are favorite habitats of burrowing animals. In fact, a considerable addition to first cost would frequently be justified to avoid a canal design or canal location that involves carrying the water high above the ground surface.

REQUIRED EXCAVATION VARIES WITH DEPTH OF WATER.

To compare cost of construction of relatively shallow with deep canals, let it be assumed (Fig. 1) that the ground surface is smooth and horizontal across the line of the canal; canal banks and levee slopes 2 to 1; width of levee crest 8 ft.; safety margin (levee crest above water surface) 2 ft.; and let w represent the bed width, d the water depth, c the required cut or depth of excavation, and h the height of the canal levees. Then on the further assumption that there will be no shrinkage of the excavated material (which is, in fact, occasionally as much as 10%), and that for the length of canal considered in this theoretical illustration the amount of excavation in each unit (foot) length of the canal will exactly equal the amount of the embankment for that length, the following relations are established:

(1) $c = (d + 2 - h)$

(2) Exc. per lin. ft. $= wc + 2c^2 = 4h^2 + 16h$, in cu. ft.

(3) Exc. per lin. ft. $= \dfrac{wc + 2c^2}{27} = \dfrac{4h^2 + 16h}{27}$ in cu. yds.

(4) $h - 2$ = height of water above ground.

From these relations Table I. has been prepared to illustrate by a few specific examples the effect of water depth upon the required excavation in the assumed case of continuous economic depth of cutting (balanced cut and fill). In order that results may bear comparison, the same mean velocity as above stated, 2.5 ft. per sec., is assumed throughout. The following relation between canal capacity, Q, in cubic feet per second and the bottom width and water depth of the canal has been used in obtaining the values inserted in the table: $Q = 2.5\ (wd + 2d^2)$.

In Table I., as already stated, excavation is assumed equal to fill. When there is much shrinkage of the material placed in bank the excavation will exceed the fill. The required depth of cut and required excavation will then be somewhat greater than here shown, but the principle to be illustrated remains the same.

It is self-evident that excavation by ordinary methods (horses and scrapers) from a canal with a capacity of 1,200 sec.-ft., a depth of 12 ft., a bottom width of only 16 ft. at 7.86 ft. below the ground surface, excavation from which must be piled up within prescribed limits in levees 6.14 ft. high, will cost more per cubic yard than the

TABLE I.—EFFECT OF WATER DEPTH ON REQUIRED AMOUNT OF EXCAVATION FOR IRRIGATION CANALS.

Depth of water, ft.	Bed width, ft.	Height of levees, ft.	Water surface above ground, ft.	Required cut, ft.	Required excavation per lin. ft., cu. yds.
	Canal Capacity 200 sec.-ft.				
2	36	2.41	0.41	1.59	2.34
3	20.7	2.48	0.48	2.52	2.38
4	12	2.52	0.52	3.48	2.44
	Canal Capacity 400 sec.-ft.				
2	76	3.05	1.05	.95	3.18
4	32	3.35	1.35	2.65	3.96
6	14.7	3.52	1.52	4.48	3.92
	Canal Capacity 800 sec.-ft.				
2	156	3.37	1.37	0.63	5.67
4	72	4.18	2.18	1.82	5.06
6	41.33	4.56	2.56	3.44	5.84
8	24	4.90	2.90	5.10	6.46
10	12	5.02	3.02	6.98	6.71
	Canal Capacity 1,200 sec.-ft.				
4	112	4.61	2.61	1.39	5.90
6	68	5.30	3.30	2.70	7.34
8	44	5.74	3.74	4.26	8.28
10	28	4.00	4.00	6.00	8.89
12	16	6.14	4.14	7.86	9.22
	Canal Capacity 2,400 sec.-ft.				
4	232	5.18	3.18	0.82	7.10
6	148	6.29	4.29	1.71	9.59
8	104	7.11	5.11	2.89	11.75
10	76	7.72	5.72	4.28	13.41
12	56	8.15	6.15	5.85	14.67
16	28	8.64	6.64	9.36	16.20

excavation of the material from a canal of like capacity with a depth of 6 ft. and a bed width of 68 ft., requiring a cut of only 2.70 ft. and levees 5.30 ft. in height. There is a better opportunity for disposing the working force in the broad shallow canal than in the narrow deep canal, and the excavated material has to be elevated to a less height. The work done per team is greater and a larger force can be employed to advantage, thereby reducing the time required to do the work. The runways will be low and will obstruct only a very small proportion of the canal width. It may also be suggested that in most cases the finishing and trimming to prescribed lines of the excavation and embankment slopes and levee crest, on account of the greater area of these surfaces in the case of the deep, narrow canals, will add more to the cost of such canals than will be added to that of the shallow canals by reason of more bottom to be graded. It is quite possible that all of the unfavorable conditions above named would make the unit cost of team and scraper work, on a canal of moderate capacity planned to carry 12 ft. of water, from 25 to 50% greater than on a canal of the same capacity planned to carry water 6 ft. deep. Specific unit costs and percentages of increased cost are herein used to illustrate a point without any intention of suggesting that they are based on any definite analysis.

A canal of 1,200 sec.-ft. capacity, 6 ft. deep, at a unit price of 12 cts. per cu. yd. for excavation would cost $7.34 \times 0.12 = \$.88$ per lin. ft. of canal.

The same canal, 12 ft. deep, if the unit price be assumed to increase 25%, would cost $9.22 \times 0.15 = \$1.38$ per lin. ft., or 57% more than the shallower canal.

It remains to be stated in this connection that in cases where hillside or other conditions have made it necessary to plan some portion of a canal deep, this is not a valid reason for continuing the same depth out upon the flat ground. The water surface may be dropped or depth may be gradually reduced by making the gradient of the canal bottom less than that of the water surface, or in some cases the narrow, deep hillside canal may be flared out and made shallow without loss of water-surface elevation. There will be, in the last two cases, no loss of head due to the change in the elevation of canal bottom other than the frictional and other losses due to expansion of width and contraction of depth in the transition from one cross-section to the other. These losses will be too trifling to take into account if the transition be made gradual.

It is always desirable, however, when depth is reduced by an up grade of the canal bottom, to provide sluice-gates at the point where a reduction of depth occurs because the canal does not always flow full, and when not full the deep upper section will act as a sump that may require occasional sluicing out.

With some regard to the desirability of not making the canals too wide, it appears from the

foregoing tabulations that on flat ground and with fall to spare the depths adopted should be:

For capacities of 200 sec.-ft. between 2 and 4 ft.
" " 400 " " 3 and 5 ft.
" " 800 " " 3 and 7 ft.
" " 1,200 " " 4 and 8 ft.
" " 2,400 " " 4 and 10 ft.

The preference should be for depths approaching the lower limits here noted, when there is no objection to wide canals. There may be such objection, however, where right-of-way is costly and where the ground's surface departs materially from an even surface.

The practice of the engineers in charge of canal construction in India is thus given by Mr. H. M. Wilson, in his account of irrigation in India, Water Supply Paper No. 87, of the U. S. Geological Survey:

On the Western Jumna Canal the proportion of depth to width is that which the Jumna River has in the course of years formed for itself, found by trial to be about 1 on 13. On the Bari Doab the proportion fixed in construction was 1 on 15, and on the Sirkind 1 on 14. In the case of the Nira Canal, which is non-navigable and of a smaller capacity than those just described, the proportion is much less, the depth being 7½ ft. and the bottom width 23 ft. On the Soane the main western line has a depth of 10 ft. and a bottom width of 100 ft., or a proportion of 1 on 11. The Betwa, which like the Nira, is non-navigable, is relatively deeper than the larger canals being 5 ft. deep to a 15-ft. bed width, on some branches, and on others 6 ft. deep to a 30-ft. bed width.

The San Joaquin and Kings River Canal, situated on the west side of the San Joaquin River, in California, was constructed over 30 years ago. It was given a bottom width of 28 ft., a depth of 4 ft., and side slopes of 2 to 1. These slopes were subsequently flattened to 5 to 1 because they could not be maintained. After the canal had been in service some 12 years and the banks had become seasoned, it was cleaned out and enlarged to a bottom width of 45 ft., the banks being allowed to stand almost vertical.

As a general safe guide, but remembering that a wide range of departure from the standards is allowable, the following relations of depth to width on the water surface may be accepted. The ratios noted are somewhere near the means indicated by engineering practice. The greatest departure therefrom is found on some of the canals of Egypt, which are relatively deep, but which it is understood usually carry their water little if any above the general surface of the country.

Calling the water surface width W_s and the depth d

For W_s = 6 make $\frac{W_s}{d}$ = 4 or d = 1.5
" W_s = 10 " $\frac{W_s}{d}$ = 6 or d = 1.6
" W_s = 20 " $\frac{W_s}{d}$ = 8 or d = 2.5
" W_s = 40 " $\frac{W_s}{d}$ = 12 or d = 3.3
" W_s = 100 " $\frac{W_s}{d}$ = 16 or d = 6.7
" W_s = 200 " $\frac{W_s}{d}$ = 22 or d = 9.0
" W_s = 300 " $\frac{W_s}{d}$ = 27 or d = 11.0

THE CANAL GRADIENT IN ITS RELATION TO DEPTH OF WATER.

As already stated, there may be requirements, due to location of lands to be covered or difficulties to be surmounted, that compel the use of light gradients and that may therefore make it necessary to favor a deep, narrow canal in order to secure a maximum hydraulic radius and a maximum velocity for the allowable fall. Generally, however, but little is gained in an attempt to hold a canal high by making it deep. In such cases the cost of covering the additional acreage should be carefully analyzed.

A general mathematical demonstration (velocities calculated by Kutter's formula) has not been attempted to illustrate how much higher a deep canal could be carried than a shallow canal, but an example or two will illustrate how little is gained by the adoption of the deep type of canal.

The required fall noted in Table II., for canals of varying capacity, is based on Kutter's formula, with the value of *n* taken at 0.025. Being merely for the purpose of illustration, fall was determined by a method of approximation without attempt to secure absolute accuracy:

TABLE II.—REQUIRED FALL FOR CANALS OF VARYING CAPACITY.

	Velocity = 2 ft. per sec.			Velocity = 2.5 ft. per sec.		
Capacity, sec.-ft.	Depth, ft.	Fall per mile, ft.	Fall in 20 miles, ft.	Depth, ft.	Fall per mile, ft.	Fall in 20 miles, ft.
400	4	1.2	24	4	2.3	46
400	6	0.9	18	6	1.7	34
1,200	6	0.64	12.8	6	1.22	24.4
1,200	8	0.43	8.6	8	0.79	15.8
1,200	12	0.37	7.4	12	0.63	12.6
2,400	6	0.55	11.0	6	0.88	17.6
2,400	8	0.39	7.8	8	0.64	12.8
2,400	12	0.28	5.6	12	0.48	9.6

Six feet depth of water in a canal with 400 sec.-ft. capacity would, in a length of 20 miles at a mean velocity of 2 ft. per sec., give this canal an advantage in elevation of about 6 ft. over a canal of like capacity with water only 4 ft. deep. At a mean velocity of 2.5 ft. per sec. the advantage in elevation for each 20 miles would be about 12 ft.

A 12-ft. depth of water in a canal with 1,200 sec.-ft. capacity would, in a length of 20 miles, at a mean velocity of 2.5 ft. per sec., give this

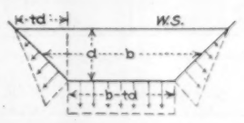


Fig. 2. Illustrating Effect of Depths on Seepage from Irrigation Canals.

canal an advantage in water surface elevation of 3 ft. over a canal of like capacity with water 8 ft. deep, and of 12 ft. over a canal with water 6 ft. deep. At a mean velocity of 2 ft. per sec., the advantage resulting from a 12-ft. depth over an 8-ft. depth would be only a little more than 1 ft., and over a 6-ft. depth would be about 5½ ft. in 20 miles of length.

In the case of a canal with a capacity of 2,400 sec.-ft. the elevation advantage resulting from a 12-ft. depth over an 8-ft. depth (mean velocity at 2.5 per sec.) would be about 3.2 ft. in 20 miles; and at a mean velocity of 2 ft. per sec. it would be about 1.2 ft.

LOSS BY SEEPAGE AS AFFECTED BY THE SHAPE OF THE CANAL CROSS-SECTION.

The losses of water from unlined canals, as usually taken into account, are the loss by evaporation and the loss by seepage. The evaporation from the water surface of a canal will rarely be in excess of 6 ins. in depth per month during the irrigation season, and generally but little more than one-half or two-thirds of this amount throughout the year. These amounts are so small when compared with seepage losses that it is common practice to consider the two causes of loss together.

Take the case of a canal with a capacity of 1,200 sec.-ft., a depth of 6 ft., and a water surface width of 92 ft. The evaporation loss from this canal will be only about 0.1 sec.-ft. per mile during the irrigating season. The seepage loss, on the other hand, under ordinary conditions from the same canal will rarely be less than 5 sec.-ft. per mile, and may be greatly in excess of this amount.

The lack of data relating to loss of water by seepage from unlined earth canals is frequently embarrasing to the engineer who is called upon to design an irrigation system. He is forced to use his judgment, in this matter, often making assumptions that are more or less uncertain, thereby rendering strict adherence to formulas, based on theoretical considerations, unnecessary.

Seepage from a canal is materially influenced by the position of the water table in the country through which the canal is cut. The effective pressure under which water is forced into the pervious material composing its bed can not exceed the difference in elevation between the surface of the ground water and the canal water surface. If the canal should lie in a deep cut with its water surface as low as the soil water then there will be no seepage loss.

For this discussion it is assumed that the surface of the soil water is and remains below the level of the bottom of the canal. It is also assumed that the canal bed is uniformly pervious. It is generally accepted as a fact that under such circumstances the seepage from the canal will at any point of its bed be proportional to depth.

Let S = seepage per unit of length.
Let A = cross-section area of the waterway.
Let b = width at middepth.
Let d = depth of water.
Then $bd = A$.
Assume bank slopes of t to 1.

$$\text{Then } S = C\,[d\,(b - td + d\sqrt{t^2+1})],$$
$$= C\,[A + d^2\,(\sqrt{t^2+1} - t)]$$

where C is a constant varying with character of material composing the canal bed and with the unit adopted (foot, meter, etc.):

For t = 0, banks vertical, seepage = C (A + d²)
" t = ½, slopes ½ to 1, " = C (A + 0.62d²)
" t = 1, " 1 to 1, " = C (A + 0.41d²)
" t = 1½, " 1½ to 1, " = C (A + 0.30d²)
" t = 2, " 2 to 1, " = C (A + 0.24d²)
" t = 3, " 3 to 1, " = C (A + 0.16d²)

For a canal with an area of 80 sq. ft. and a depth of 4 ft.:

When bank slope is vertical, then seepage = 96C
" " " ½ to 1, " " = 90C
" " " 1 to 1, " " = 87C
" " " 1½ to 1, " " = 85C
" " " 2 to 1, " " = 84C
" " " 3 to 1, " " = 83C

For a canal with area = 160 sq. ft. and a depth of 4 ft.:

When bank slope is vertical, then seepage = 176C
" " " ½ to 1, " " = 170C
" " " 1 to 1, " " = 167C
" " " 1½ to 1, " " = 165C
" " " 2 to 1, " " = 164C
" " " 3 to 1, " " = 163C

For a canal with area = 480 sq. ft. and a depth of 6 ft.:

When bank slope is vertical, then seepage = 516C
" " " ½ to 1, " " = 502C
" " " 1 to 1, " " = 495C
" " " 1½ to 1, " " = 491C
" " " 2 to 1, " " = 489C
" " " 3 to 1, " " = 486C

For the same canal, area = 480 sq. ft., but depth 12 ft.:

When bank slope is vertical, then seepage = 624C
" " " ½ to 1, " " = 569C
" " " 1 to 1, " " = 538C
" " " 1½ to 1, " " = 523C
" " " 2 to 1, " " = 515C
" " " 3 to 1, " " = 503C

It is apparent from these illustrations that the loss of water by seepage will be somewhat less from canals with flat slopes than from canals with steep slopes. It is also apparent that the seepage loss increases materially as depth increases.

The assumption of uniform material in the canal bed is always more or less in error, and the primary assumption of a loss proportional to depth is only correct when the degree of saturation of wetted soil near the canal and dispersion of seepage water into subsoils is uniform in all directions and at all points of the canal. It is found in practise that the proportional seepage loss from the small canal or ditch is larger than from the large canal. This consideration often leads the experienced engineer to express the seepage loss in cubic feet per second per mile rather than in percentage of flow. It also points to the desirability of restricting any assumed percentage of loss to canals not varying too greatly in capacity. In other words, loss expressed in percentage, or proportional loss, must vary considerably with varying volumes of flow.

The loss of water from canals by seepage and evaporation is, nevertheless, for reasons of convenience, usually expressed in percentage of the canal flow. In fact, it is common practise to express total loss in canals of whatever length in percentage of the water admitted at the canal head. When this is done some explanation of the basic facts which lead up to the percentage statement becomes necessary, because, as is self-evident, the loss decreases with the decreasing flow in each succeeding unit of the canal length. It may, for ordinary purposes, be assumed that the loss in successive units will remain directly proportional to the volume of flow. On this assumption, if the ratio of the loss (S) to the total flow (Q) in a unit length of the canal be called r, ($r = S/Q$), the water entering the second unit length or section would be $Q\,(1-r)$, and the water at the upper end of the n^{th} unit section would

be $Q\ (1 - r)^{n-1}$. The unit section for short canals may be taken at one mile; for long canals at 5 miles.

For example, let it be assumed that the seepage and evaporation loss from a 5-mile section of canal has been found to be 2%, and it is desired to know what part of its flow would reach the end of a 100-mile stretch, uniformity of conditions as above explained being assumed. In this case $n = 21$, there being 20 sections of 5 miles each in the 100 miles.

$$Q_{21} = Q\ (1 - .02)^{20}$$
$$= .67\ Q.$$

That is, about 67% of the water would be available for delivery at the end of the canal and about 33% would be lost.

As a second illustration, let it be assumed that the loss from a 5-mile section is 5% and the length of the canal again 100 miles. In this case

$$Q_{21} = Q\ (1 - .05)^{20}$$
$$= .36\ Q.$$

That is, about 36% of the water would be available for delivery, and the total loss would be about 64% of the flow of the canal at its head.

The combination of the loss by evaporation with the loss by seepage, as in the above illustrations, is justified, not only by the fact already stated, that, when compared with seepage, evaporation is a relatively small, almost negligible, quantity, but by the further fact that within moderate limits of changes in the amount of flowing water, the evaporation loss may be assumed, without material error, to be proportional to the canal flow.

GENERAL REMARKS.

In planning canals the engineer should not be misled into using too low values for the coefficient of friction. When in doubt between two values it is better to use the higher value for n in the Kutter formula. This gives the larger cross-section, and if it should turn out that, in the constructed canal, velocities are greater than estimated and require reduction, this reduction is easily obtained by constructing occasional checkweirs or drops.

Checkweirs, of the type with removable weirboards, are, moreover, desirable features of all important irrigation canals. New main canals rarely come into service at full capacity (unless they are feed canals for storage reservoirs), and it may be many years before irrigation requirements will fill them. A checkweir in such canals every few miles will permit water to be held at considerable depth in the canal even when the discharge is small, thereby keeping canal banks moist and decreasing danger of break during periods when the canal is flowing at or near its capacity. In bringing the canal up to full duty much less trouble will therefore be experienced on a canal well provided with checkweirs than if there were no checkweirs. Checkweirs are, as stated, good regulators of velocity, and in a new canal they afford a means for filling the canal with practically dead water. This water can be held in the canal for any length of time, without any embarrassing discharge of water at the lower end of the canal, thereby wetting the embankments and promoting plant growth, which will act as a protecting agent. The water can be put on or off at will, and the banks will attain their permanent condition much sooner than if the head gate affords the only means of regulating flow and water surface elevation.

The foregoing discussion of canal types applies to laterals as well as to main irrigation canals. Perhaps even more generally to laterals, because laterals usually follow the greatest slope of the country, and are therefore rarely upon ground that slopes transversely to the direction of the canal.

It should be stated that as the foregoing discussion deals mainly with large canals, the crest width of canal embankments was assumed at 8 ft., and the safety margin was placed at 2 ft. The principle is the same for other embankment dimensions. In good material a smaller safety margin may be allowable, and the crest width may be reduced. Smaller values of crest width of levee and of safety margin would of course have been assumed if smaller canals had been used for purposes of illustration. It should also be noted as desirable that one embankment of important canals, preferably the lower side embankment, be made wide enough on top for a convenience road.

In planning canals, some consideration must always be given to methods of construction. When machinery is used the height to which excavated material must be lifted may have very little effect on the cost of the work. This is not so in the ordinary canal work requiring the use of scrapers and teams. No rule has been formulated for the rate of increase of cost with depth for the ordinary canal dimensions. But it is practically axiomatic that the unit cost will increase with increasing steepness of banks and that it will also increase with increasing depth of water.

It is generally recognized as desirable that the water in an irrigation canal should have the maximum mean velocity that the canal bed (assuming the same to be earth, sand or gravel) can stand without being eroded. The velocity that is effective in eroding the banks or bottom of a canal, or which in firm material is effective in keeping the canal free from objectionable deposits, is not the mean velocity, but the velocity at the canal sides and at the bottom, which in all ordinary cases is less than the mean velocity. In a relatively deep, narrow canal the reduction of velocity below the mean velocity is less toward the bottom and sides than in the case of a broad, shallow canal; consequently, the broad, shallow type will permit the use of somewhat higher mean velocity, and therefore a somewhat smaller cross-section area than the deep canal.

The foregoing considerations point to the broad, shallow type of canal as the best, when not prohibited by gradient requirements, by hillside or transversely sloping ground, or by high right-of-way cost.

There are several points, however, in favor of the narrow, deep canal which may in certain cases be given some weight in reaching a decision upon the cross-sectional dimensions.

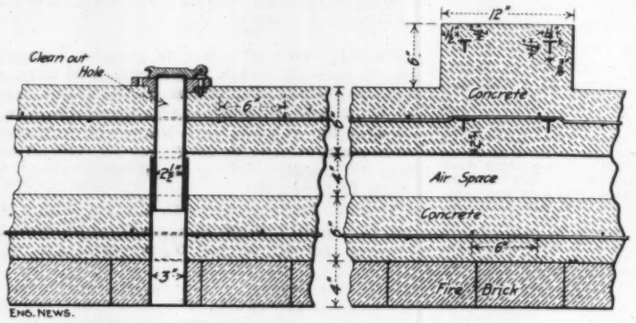
The canal with deep water will be less obstructed by vegetable growth than the canal with shallow water. This is particularly true if currents are sluggish. In the warm regions of the South and Southwest this fact should be given due weight in all cases where velocities cannot be maintained sufficiently high to keep down the growth of aquatic plants.

Again, there are cases in which a canal must be in service a long time at only fractional capacity. Mean velocity will in such cases be greatest in the canal planned for the greatest depth of water. This is an important consideration if the canal is to carry muddy water or to transport much sand on light gradients.

It may be stated that in an ideal canal system the silt in the water that cannot be removed by special sluicing devices should be carried along through main canals, through laterals and irrigating ditches to a final disposal upon the lands irrigated.

REINFORCED-CONCRETE BOILER SETTINGS.

The continued high maintenance charges for brick boiler settings led the Neches Canal Co., of Beaumont, Tex., during the past year to substitute, for the brick in two boilers, a special design in which reinforced concrete is the main feature. In general outlines the setting is similar to those of brick. It consists of a hollow concrete wall, buttressed at the corners and at intervals on the sides with exterior pilasters, and lined on the inside with fire brick. The main walls are reinforced, both horizontally and vertically, with round rods and the pilasters with vertical T-rods. In the accompanying figure a plan and elevation section are each shown, from which the general construction may be readily understood.



Part Vertical Section. Part Horizontal Section.

DETAILS OF REINFORCED CONCRETE BOILER SETTING AT POWER PLANT OF NECHES CANAL CO., BEAUMONT, TEX.
(Designed and erected by Weber-Duller Construction Co.)

It was at first thought that the cost of these concrete settings would be prohibitive, but the estimate on the design showed a cost equal to that for similar brick settings made some years ago, while the actual construction was about $100 less per setting than the estimate. The following table shows the cost figures for one of the two settings installed:

COST OF CONCRETE BOILER SETTING AT NECHES CANAL CO., BEAUMONT, TEX.

Foundations:		
Excavation 14 ins. deep	$6.75	
Mixing and placing concrete foundations.	5.25	
Cement in foundations, 5 bbls.	6.25	
Rock, 5 cu. yds., at $2.25	11.25	
Sand, 2½ cu. yds., at $1	2.50	
		$32.00
Above Foundation:		
Labor at $1.50 per day	$108.50	
Brick mason at $4.50 per day	84.75	
Cement in walls and setting, 238 sacks	134.00	
Sand, 30 cu. yds.	30.00	
Fire brick, 5,000	150.00	
Fire clay, 1 ton	10.00	
Steel, 190 bars ¼-in. rd. × 14 ft. long		
Steel, 52 bars ¼-in. × 21 ft. long		
Steel, 64 bars ¼-in. × 20 ft. long		
0.167 lb. per ft. = 840 lbs., at 3 cts.	25.20	
Steel, 32 T bars, 1¼-in. × 15 ft. long	32.41	
		570.86
Form Lumber:		
About 1,000 ft. lumber	$32.00	
Carpenter work	14.00	
Special blow-outs, 14	14.00	
Asbestos cement, 5 sacks, at $2	10.00	
Mineral wool, 3 sacks, at $1.65, 100 lbs. per sack	4.95	
Cement finisher	10.00	
		$84.95
		$687.81

Crude oil is used for fuel under these boilers, giving higher boiler temperature than for coal, but constant use for the past four months has failed to show any defects. The engineer of the canal company is keeping temperature readings on the different walls and the air space and, in the near future, it is hoped that some valuable data will be available from these observations.

We are indebted to Mr. David M. Duller, General Manager of the Weber-Duller Construction Co., of Houston, Tex., who designed and erected the settings, for the information in this article.

SHOP MANAGEMENT.*

By H. F. J. PORTER.†

It seems almost unnecessary to say that better results are attainable in a shop where neatness and orderly methods are maintained than where the reverse is the case. And yet it is surprising how many shops there are whose physical conditions are such that not only can work not be performed economically in them, but where good mechanics would have to work under such handicaps that they actually refuse to go there.

I have found that there are no hard and fast rules to be applied to all works. Each plant presents a complex problem of its own which has to be analyzed, studied and solved by itself. But in every case there is one element which must be reckoned with and that is human

*Extracts from a paper given before the convention of the American Foundrymen's Association, Toronto, Ont., June 9-11, 1908.

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nature. Especially must we recognize the common interests of the others who are involved in our enterprise and give them the means of expressing their wishes in order that harmony of action between them and us may be attained, and we all may work together for the same end.

It is an interesting question in each case to decide what type of management will secure the best results. It used to depend largely upon the manager's knowledge of all the details of the business. Nowadays, however, the work is so specialized that one man cannot know it all, and consequently a more diversified system of management becomes necessary.

I shall never forget a conversation I once had with a Japanese naval officer who was sent here some time ago to negotiate with Cramps' shipyard for some battle ships for his government. We were discussing the relative merits of the monarchic and democratic forms of government and after his analysis of the systems, he said:

I have looked back over the history of the growth of countries which have been controlled by these two systems respectively, and I am compelled to decide in spite of the theory, and that viewed from actual experience the democratic system is the best. Japan is taking active measures to adopt its principles.

Now, concretely, what is there fundamental in this system, which we can incorporate in the methods of governing our Industrial Organizations? For we must recognize the fact that the principles of government are the same whether a large or small number of people to be governed is involved.

At present in our system of education, there is no method of educating any one to manage, and so we find that in the ultimate analysis it is the judgment of the whole, of all those, whose common interests are at stake which by its expression becomes of greater potential value in the long run than the more contracted one-sided judgment of a part, which becomes self-interested at the expense of the remainder. This is government by public opinion.

In "The American Commonwealth" Mr. James Bryce says:

Towering over presidents and state governors, over Congress and state legislatures, over conventions and the vast machinery of party, public opinion stands out in the United States as the great source of power, the master of servants who tremble before it. . . . It grows up not in Congress, not in state legislatures, not in those great conventions which frame platforms and choose candidates, but at large among people. It is expressed in voices everywhere. It rules as a pervading and impalpable power like the ether which passes through all things. It binds all the parts of the complicated system together and gives them whatever unity of aim and action they possess.

And so in my reorganization work in factories I have found that where there is a tendency to centralize power in a one-man regime the growth of the enterprise is narrowed to just the scope of that one man's capabilities. Whereas, if every individual in the organization is given the opportunity and the privilege to express his views and his reasons for them on matters regarding which they may be of value, if whatever there is good in that presented is accepted for what it is worth, then at once the management is reinforced by the potential knowledge possessed by the brains of the whole organization and the success of the enterprise becomes enormously enhanced.

By practical experience I have found that this result can be secured with very slight disturbances of the regular routine of the shop, if we organize the shop forces on a democratic system of government very similar to that which exists in our states or at the National Capital.

According to this plan there is first formed a lower house, or "Works Committee" composed of representatives elected one from each department of the shop and office. Lots are drawn so that the terms of service of the members cease in rotation so that one drops out each month and a new member is elected in his place. This arrangement allows of a gradual but complete change in the personnel of the committee in the course of a year or so, and gives many men in the shops a chance to serve. A chairman is elected by the committee from its members. The upper house or "Advisory Board" is composed of the shop foremen and the heads of the other departments. These remain permanently in office and are presided over by the General Manager. To provide subjects for these two bodies to consider a "suggestion system" is established. This consists of locked boxes distributed throughout the departments. Through a slot in each can be dropped signed suggestions on proper blanks prepared for the purpose. No anonymous communications are recognized. These suggestions may be on improvements (1) in design, (2) in workmanship or (3) material entering into the product, (4) in processes of manufacture, (5) in methods of business and (6) in conditions about the shops.

These suggestions are periodically collected by some one selected by the works committee as secretary, who copies them with the name of the author removed, submits them to the works committee for consideration, and keeps a careful record of the recommendations for adoption or rejection of each.

The minutes of the committee, consisting of these recommendations, are posted on bulletin boards in the shops and the following week they come before the Advisory Board for consideration. The chairman of the works committee is admitted to the meetings of this board by courtesy, but without power to vote. These minutes, consisting of the endorsement or rejection of the recommendation of the works committee are in turn posted on the bulletin boards in the shops and finally brought to the President by the General Manager for final disposal. An estimate of the cost of installing each is made as well as an estimate of the value to accrue from it, and a balance is struck. All those which are accepted by him are paid for.

It is also found advantageous in some cases to pay quarterly a bonus to the employee making the best or greatest number of suggestions, and to the foreman from whose department the greatest number emanate. The object in posting the minutes of the meeting in the shops is to insure publicity of the actions on all suggestions submitted. Right here is where public opinion is created and herein lies the success of the system. This publicity tends to restrain the rank and file from making foolish suggestions and prevents the two committees from acting otherwise than fairly on what comes before them. It is surprising how the establishment of this system develops and broadens the organization, and tends to make both management and employee look on matters of common interest from a wider angle than before. This closer touch which comes from bringing management and employee together leads both to think more nearly right and no man need be feared who is conscientious and thinks right.

This more intimate contact tends towards fair treatment from both sides—the employee is recognized as a human being rather than as a machine, the management is looked upon as a friend rather than a tyrant. This closer union produces harmony of action and the so-called "labor question" largely disappears.

"Shop Betterment" by the adoption of carefully considered suggestions by the employees is much more satisfactory than that which comes in a paternal manner from the management as "welfare work." The employee gets only what he can demonstrate that he needs instead of having presented to him by the management what the latter thinks he needs. He thus appreciates what he gets and makes effective use of it.

NOTES FROM ENGINEERING SCHOOLS.

COLUMBIA UNIVERSITY.—On Oct. 26 will begin an evening course especially adapted to the needs of the technical and professional workers. Instruction will be given in applied mechanics, applied physics, architecture, electricity, fine arts, industrial chemistry, mathematics and surveying and structures.

A HEAD-ON COLLISION on the Northern Pacific Ry., near Paradise, Mont., Sept. 5, resulted in the death of nine men. Passenger train No. 5, westbound, while running at 40 mi. per hr., collided with an eastbound freight. It is reported that the wreck was due to the failure of an operator to deliver an order to the passenger train.

A FORTUNATE DERAILMENT occurred to an eastbound passenger train on the Grand Trunk Ry., nine miles east of Woodstock, Ont., Sept. 3. The accident, which is ascribed to a broken rail, took place while the train was running at the rate of 50 mi. per hr. Seven cars left the track but remained upright, while the rear car and the locomotive remained on the rails.

A TRAIN WAS WRECKED at Waltham, Mass., on the Boston & Maine R. R., Sept. 1, while moving at 5 mi. per hr. The wreck was probably caused, according to the report of the railway officials, by a rod dropping down beneath the locomotive and acting as a strut to raise it from the track so that it toppled over. The engineer was crushed beneath the locomotive and killed. The locomotive was shoved along on its side by the slowly moving but heavy freight train, carrying down a signal post and a stand-pipe and pushing the tender through a fence alongside the track. The first four cars of the train left the rails but remained upright.

A FIRE IN RAWHIDE, a mining town in Nevada, destroyed the entire business portion and left 3,000 people homeless. The fire started Sept. 4 in the Rawhide Drug Co.'s building, and, owing to the inflammable construction of the buildings, swept over the whole business section of the town in two hours. Among the first buildings to burn was a hardware store in which were two tons of dynamite, and this, in exploding, scattered burning wood in all directions, hastening the progress of the fire. Several buildings were demolished with dynamite by the miners to prevent the spread of the flames. The hoisting works of the Bluff Mining Co., the Grutt Hill properties and the Grutt business offices were burned.

FOREST FIRES are reported in Wisconsin, Minnesota and Michigan. Chisholm, Minn., a town of 4,000 inhabitants, is said to have been completely destroyed Sept. 5. The Pillsbury and Martley mining properties of the U. S. Steel Corporation, near Hibbing, Minn., were likewise burned. The towns of Buhl, Bovey and Grand Marais are surrounded by fire and Hibbing is endangered. Many square miles of forest land have been devastated. The entire northern portion of Douglas Co., Wis., is reported to be on fire. In Michigan, heavy losses have been suffered in the upper peninsula, and forest fires were reported Sept. 8 in Houghton Co. and Ontonagon Co., which threaten the Calumet copper region.

The main lines of the Canadian Pacific Ry. have been tied up by a combination of brush fires and wash-outs so that trains from Winnipeg, Man., to eastern points in Canada were sent by way of St. Paul.

THE ILLINOIS & MICHIGAN CANAL was damaged on Sept. 2 by a breach in the bank about 12 miles below Joliet, Ill. This drained the 20-mile section between the Jackson St. dam at Joliet and the Channahon dam. A number of barges and pleasure boats were stranded, and some cereal mills at Joliet were shut down for lack of power. A considerable area of land was inundated. The breach is said to have been caused by dynamite, and, on account of recent threats, is attributed to farmers along the canal. The canal intersects a number of highways, and for some years the bridges were maintained by the canal commission. With the decrease of canal traffic the earnings have been insufficient to maintain the canal and bridges, and as the state has no authority to provide funds for the bridge work, it is held that the townships must look after the bridges. Many of the structures are reported to be in bad condition; some have been declared unsafe and the highway commissioners have closed the approaches. Farmers along this part of the canal are said to have made numerous threats, and one of the bridges was burned on Aug. 30. Governor Deneen has ordered an investigation made, and the damage will be repaired at once. The canal extends from Bridgeport (on the Chicago River) to the Illinois River at La Salle, Ill., a distance of about 100 miles.

A QUEBEC BRIDGE COMMITTEE was recently appointed by the Governor-in-Council at the suggestion of the Dominion Department of Railways and Canals. It consists of three members: Mr. Maurice Fitzmaurice, of London, Chief Engineer of the London County Council; Mr. Ralph Modjeski, of Chicago, Consulting Engineer, and Mr. H. E. Vautelet, of Montreal. This committee may be increased later by the addition of two or three further members. The committee has already begun its work, visiting the site of the wrecked structure a week ago. It is understood that the committee is not bound in any way in planning the crossing, to the extent that even the selection of the site is subject to their investigations.

THE AEROPLANE, built for the Signal Corps of the United States Army by Orville and Wilbur Wright, of Dayton, Ohio, in the builders' preliminary trials at Fort Meyer, Va., has been given several flights since Sept. 3. While no records have been attempted, complete control of the action of the machine seems to have been secured. It is generally expected that Mr. Orville Wright, who is operating the machine, will have little difficulty in meeting the official requirement of one hour's continuous flight.

On Sept. 5 Mr. Wilbur Wright, with a similar machine, made a successful flight of about 15 miles in 19 min., 48⅘ sec., at Le Mans, France. The average height above the ground was 35 ft. and the speed was reported as something over 37 miles per hr.

Leon Delagrange established a new world's record for a heavier-than-air-machine flight on Sept 6 at Issy, near Paris, France, by remaining aloft 29 min., 54⅘ sec., and circling the field at Issy 15¼ times.

OVERHEAD HIGH-TENSION TRANSMISSION WIRES of the New York Central & Hudson River R. R.'s electric terminal system are the subject of an interesting decision recently made by the Public Service Commission, New York City. The case was noted in our issue of Aug. 6, p. 152. The transmission line from the power-houses to the substations of the railway where on the company's right-of-way is for the most part an overhead line; about 10.4 miles of this line are within the limits of New York City. The line is carried generally on built steel poles, with a minimum clearance of lowest wire of 22 ft. above the surface; the highest pole is about 68 ft. long. The poles carry at the maximum two three-phase 11,000-volt lines, and up to 6 cables ranging from 600 to several thousand volts, besides a pair of telephone cables. They are designed to carry four three-phase lines ultimately. The city authorities believed that this line constituted a public danger, and made complaint to the Public Service Commission. Experts for both parties testified that the line as built is, with minor exceptions, as substantial and safe as it can be made, but they differed in their opinions as to the relative safety when compared with a conduit line. A strong point was made of a recent derailment on the New York,

New Haven & Hartford Ry. (see reference cited above) as showing that a train accident might destroy a pole of the transmission line and endanger lives through the falling of the high-potential wires. The Commission found, however, that the argument against the sufficient safety of these overhead lines is not sufficiently strong, especially as the company's right-of-way is fenced by a high iron picket fence. Moreover, a large mileage of high-tension overhead transmission within the city limits is already in service on the Long Island R. R., under permits from the city, and this line is much less securely guarded than the line complained of. The Commission therefore dismissed the complaint, on an understanding that the company will install guard-wires over its line where telephone or telegraph lines cross above it, will replace certain wooden poles by steel poles, and will lengthen the poles in a specified section. The city did not care to order the wires put underground where they cross public streets, if they were left overhead in the intermediate portions (where the city authorities have no immediate jurisdiction). The Commission's decision therefore virtually settles the matter for the street-crossings also.

OVERHEAD HIGH TENSION WIRES IN NEW YORK City were reported in the course of the hearing noted just above, as follows, in addition to the 10.4 miles of the New York Central: Long Island R. R., 40 miles; Manhattan borough, 1 mile; Brooklyn borough, 145 miles; Bronx borough, 92 miles; Queens borough, 172 miles; Richmond borough, 150 miles. The total is about 610 miles. This includes about 500 miles at potentials of 1,000 to 3,000 volts, and about 100 miles at potentials from 3,000 to 11,000 volts. With the exception of the Long Island R. R. and New York Central lines, these overhead lines are used for electric light or trolley service and are strung along public streets.

PANAMA CANAL EXCAVATION during August totaled 3,252,506 cu. yds., a daily average for the 26 working days of 125,096, as against a total of 3,168,840 cu. yds. for the previous month, a daily average of 121,494 cu. yds., also for 26 days. The record in cubic yards for the past two months is as follows:

Steam Shovels.	August.	July.
Atlantic division	146,572	160,331
Central division	1,499,963	1,441,119
Pacific division	129,945	122,889
Dredging:		
Atlantic division	638,217	625,497
Pacific division	737,774	696,170
Canal prism total	3,152,471	3,045,956
Accessory works outside canal prism:		
By steam shovel	98,646	122,884
By hand	1,389	....
Total excavation	3,252,506	3,168,840

The rainfall during August was 11.93 ins. against 11.14 ins. in July.

THE LOCK IN THE CHARLES RIVER DAM, Boston, Mass., has been opened for the passage of vessels. The lock-gates (See Eng. News, July 9, 1908), have been completed, tested and adjusted, but will not be used until the shut-off dam is completed. Meanwhile, vessels will pass without locking. On Aug. 31 navigation, which heretofore has been conducted through a gap in the shut-off dam, was turned through the lock. We are indebted to Mr. J. Albert Holmes, Division Engineer, East Cambridge, Mass., for the foregoing information.

THE ONTARIO HYDRO-ELECTRIC COMMISSION will immediately start the construction of a high-tension transmission line from Niagara Falls to Toronto, as the result of an order of the Cabinet Council passed Sept. 3. This is the outcome of the agitation for cheap power throughout the province that resulted in the appointment of the Hydro-Electric Power Commission, whose engineering work was reviewed in Engineering News, Dec. 19, 1907. Active construction has been delayed by legal processes brought by private interests to prevent the work. This line will be about 300 miles long and will cost about $1,270,000. The line will be government-operated, but the municipalities supplied must maintain their own transformation and distribution plants.

THE STATISTICAL REPORT OF THE CLAY-WORKing industries of the United States for 1907, just issued in advance notice by the U. S. Geological Survey, shows a falling-off in value from 1906, of $2,090,353 or 1.3%, the two figures being $161,032,722 for 1906 and $158,942,369 for 1907. In the 15 items listed in the report 7 show a decrease and 8 an increase. The most marked decrease was in the product of greatest value, common brick, a loss of 4.1%, due no doubt to the general falling off in building; the most marked increase was in the second most valuable product, vitrified paving brick, which showed a gain of 5.2%. Fire-brick, sewer pipe and drain tile all showed gains, while front brick, fireproofing and tile (not drain) products used in structures of the higher class, all showed decreases in value.

A 56-MILE CABLEWAY is being built near Samarcand, in Turkestan. It extends from coal mines in the mountains south of the city to the nearest railway station, and is to handle the output of the Turkestan mining and coal company, who are building the line, according to a note in "Zentralblatt der Bauverwaltung" of Aug. 22. About a third of the line is in steep mountain territory, and an equal amount in the plain. A river over two miles wide, the Zaraphan, had to be crossed; here spans of 250 ft. carried on steel towers on concrete piers are used. The cableway has two fixed cables, on which operate skips of 8 to 10 cu. ft. capacity.

PERSONALS.

Mr. W. C. C. Mehan has been appointed Superintendent of the Grand Trunk Pacific Ry. Co., with headquarters at Melville, Sask.

Mr. C. F. Gailor, Assistant Engineer of the Goldschmidt Thermit Co., has resigned to become Roadmaster of the Connecticut Co., at Hartford, Conn.

Mr. John T. Whistler, M. Am. Soc. C. E., has resigned from the U. S. Reclamation Service and opened an office as a consulting engineer in the Chamber of Commerce Bldg., Portland, Ore.

Mr. R. M. White, formerly a roadmaster of the Delaware, Lackawanna & Western R. R., at Buffalo, N. Y., has been appointed division engineer at Scranton, Pa., to succeed Mr. G. J. Roy.

Mr. John C. Sesser, at one time Engineer of Maintenance of Way of the Chicago, Burlington & Quincy R. R., has been appointed Contracting Engineer of the Walsh Construction Co., of Davenport, Iowa.

Mr. W. E. Green, Vice-President and General Manager of the Trinity & Brazos Valley Ry., has resigned. The position of general manager is to be abolished and its duties assumed by Mr. R. H. Baker, President.

Mr. J. Francis Le Baron, M. Am. Soc. C. E., has been appointed Chief Engineer of the Sumas Development Co., Ltd., connected with the British Columbia Electric Ry. Co., of London, Eng. His office is in Vancouver, B. C.

Mr. William J. Crumpton will be in charge of the western office of the firm of D. C. & Wm. B. Jackson, Engineers, at the Commercial National Bank Building, Chicago, Ill. The western office of this company was formerly in Madison, Wis.

Mr. Nelson O. Tiffany, Jr., Assoc. M. Am. Soc. C. E., and Mr. Harry M. Gail, Mechanical Engineer, have formed a partnership and will continue their practice as engineers and contractors under the firm name of Tiffany & Gail, at 1010 Mutual Life Building, Buffalo, N. Y.

Mr. G. P. Robinson will become Supervisor of Boilers of the New York Central Lines, succeeding Mr. George Wagstaff. Mr. Wagstaff has entered the service of the American Locomotive Equipment Co., of Chicago, and not the Railway Materials Co., as stated in a previous issue.

Mr. John M. Young, Jun. Am. Soc. M. E., who has been for the past four years in the structural department of Westinghouse, Church, Kerr & Co., has resigned to become Dean of Engineering in the newly organized University of Hawaii, at Honolulu. Mr. Young sailed from San Francisco Sept. 5 to take his new position.

Obituary.

Charles A. Stearns, a retired electrical engineer and contractor of Watertown, Mass., died Aug. 12 at Weld, Me., at the age of 70 years.

John James Greenough, Superintendent of the U. S. Patent Office at Washington, from 1837 to 1841, died at Brookline, Mass., Aug. 25, at the age of 96. Mr. Greenough was an inventor and was in partnership with Prof. G. G. Page in bringing out the first "electro-magnetic engine."

Lewis Williams, the first General Manager of the New York, Chicago & St. Louis R. R., died in Los Angeles, Cal., Aug. 29. Mr. Williams was obliged to give up active railway work in 1893 on account of ill-health. He was for some time Assistant General Manager of the Cleveland Car Service Association.

Max Rosenmund, the engineer who conducted the triangulation and check surveys for the Simplon tunnel, died on Aug. 18. He was born Feb. 12, 1837, at Liestal, and passed most of his active life in the Swiss Bureau of Topography. In 1904 he went to the Federal Polytechnic at Zürich as Professor of Surveying and Geodesy.

William H. Cordell, General Foreman of the New York Edison Co., died Aug. 2 as the result of a fall. Mr. Cordell was born in 1863 at St. Louis, where he received his primary education. Previously to entering the service of the New York Edison Co., he had worked with the Thompson-Houston Co. in Lynn, Mass., and with the General Electric Co., in New York.

Frank B. Kleinhans, Jun. Am. Soc. M. E., was struck and almost instantly killed by a street car in Pittsburg, Pa., Sept. 1. He was driving on West Liberty Ave., and, in turning his horse to avoid an outbound car, was struck by an inbound car on the other track and thrown from the buggy beneath the car. His son and a nephew, five and eight years old, who were with him, were seriously injured. Mr. Kleinhans was a graduate of Lafayette College and has for several years resided in Pittsburg, where he was Chief Draftsman of the [illegible] Engineering & Foundry Co. He was 35 years old.

W. M. Habirshaw, an authority on the manufacture of insulated wire, died the second week in August from apoplexy at his summer home in Saratoga, N. Y. Dr. Habirshaw was born in New York City in 1864. He served as an engineer in the U. S. Navy during the Civil War, and was at one time employed as a chemist by the Peruvian Government. As a chemist, he studied especially the properties of rubber and gutta percha and the general subject of insulation. The India Rubber, Gutta Percha Insulating Co., which afterward became the Habirshaw Wire Co., was formed as a result of his work. Dr. Habirshaw was a member of the Chemists and the Electrical Club and of the Chemical Society of London.

ENGINEERING SOCIETIES.

COMING MEETINGS.

CENTRAL STATES WATER-WORKS ASSOCIATION.
Sept. 15-17. Annual convention at Pittsburg, Pa. Secy., Wm. Allen Veach, Newark, O.

NEW ENGLAND WATER-WORKS ASSOCIATION.
Sept. 23-25. Annual convention at Atlantic City, N. J. Secy., Willard Kent, 715 Tremont Temple, Boston, Mass.

LEAGUE OF AMERICAN MUNICIPALITIES.
Sept. 30-Oct. 2. Annual convention at Omaha, Neb. Secy., John MacVicar, Des Moines, Iowa.

AMERICAN INSTITUTE OF MINING ENGINEERS.
Oct. 1. Annual meeting at Chattanooga, Tenn. Secy., R. W. Raymond, 29 West 39th St., New York City.

ILLUMINATING ENGINEERING SOCIETY.
Oct. 6-7. Annual convention at Philadelphia, Pa. Secy., Van Rensselaer Lansingh, Engineering Societies' Building, 33 West 39th St., New York City.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.
Oct. 12-16. Annual convention at Atlantic City, N. J. Secy., B. V. Swenson, 29 West 39th St., New York City.

RAILWAY SIGNAL ASSOCIATION.
Oct. 13-15. Annual meeting at Washington, D. C. Secy., C. C. Rosenberg, 12 North Linden St. Bethlehem, Pa.

ASSOCIATION OF RAILWAY SUPERINTENDENTS OF BRIDGES AND BUILDINGS.
Oct. 20-22. Annual convention at Washington, D. C. Secy., S. F. Patterson, Boston & Maine Ry., Concord, N. H.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.
Oct. 20-23. Annual meeting at Atlantic City, N. J. Secy., A. P. Folwell, 239 West 39th St., New York City.

AMERICAN GAS INSTITUTE.
Oct. 21-23. Annual meeting at New York City. Asst. Secy., W. Bissell, 29 West 39th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY.
Oct. 30-31. Fall meeting at New York City. Secy., Dr. J. W. Richards, Bethlehem, Pa.

ROADMASTERS AND MAINTENANCE-OF-WAY ASSOCIATION OF AMERICA.
Nov. 10, 12. Annual meeting at Milwaukee, Wis. Secy., W. E. Emery, West Chicago, Ill.

THE IRON AND STEEL INSTITUTE.—The autumn meeting will be held at Middlesbrough, England, Sept. 28-Oct. 2. Among the papers to be read are the following: "Gas Producer Practice," Prof. W. A. Bone, Leeds, and R. V. Wheeler, Normanton; "The Constitution of Carbon Steels," Prof. E. D. Campbell, Ann Arbor, Mich., U. S. A.; "The Mechanical Cleaning of Iron Ores," T. C. Hutchinson, Middlesbrough; "Results of Experience with Electrically Driven Rolling Mills," C. Koettgen, London, and C. A. Ablett, London; "Relative Wearing Properties of Steel Rails," E. H. Saniter, Rotherham; "A Workshop Microscope," J. E. Stead.

WESTERN SOCIETY OF ENGINEERS.—The first meeting of the season was held Sept. 2 in the new rooms of the society in the Monadnock Block, Chicago.

The paper presented was on "The Analysis of an Hydro-Electric Project," by Mr. H. von Schon. This paper set forth the special advantages of water power as compared with steam, and the advantages of electricity for operating machinery. It was stated that the present power consumption in the United States, for industrial and public utility services, aggregates 15,000,000 HP. Of this amount, water power is credited with 2,000,000. The undeveloped water power possibilities were estimated at about 10,000,000 HP. under the normal conditions of flow. The market for power is widespread, and the analysis of this market is an engineering work.

This analysis includes (1) the franchise; (2) the present and prospective consumption; (3) the power load (with lighting load as of secondary importance); (4) the restrictions of use of water by federal, state or other laws and regulations; (5) the area which will be overflowed by the construction of the dam; (6) the stream flow, which may be determined or estimated from government records; (7) the character of the construction works required; (8) the generating equipment; (9) the transmission equipment.

The investigation should be divided into three distinct and separate parts: (1) the market; (2) the approximation of output and cost; (3) the precise estimate.

CONSTRUCTION NEWS

Supplement to ENGINEERING NEWS. 220 Broadway, New York, September 10, 1908.

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CONSTRUCTION NEWS.

PLANS AND SPECIFICATIONS ON FILE.

(*) denotes that this work is advertised in Engineering News.)

The following Plans (P.) and Specifications (S.) are on file and may be seen at the office of The Engineering News Publishing Co., 220 Broadway, New York.

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9-15*	Bridge,	Amsterdam, N. Y. (S)..	8-27
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10- 8*	Lift bridge,	Wash., D. C. (S).....	9- 3
12- 1	Dredging,	Hawaii .....(S.)	9-10

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9-18 Vacuum system, Rochester, N. Y..... 8-20
9-19 Quarters, Ft. Baker, Cal..... 9- 3
9-20 Plans, Tulia, Tex..... 9-10
9-21 Court-house, Mercer, Pa..... 9-10
9-21 School, Cleveland, Ohio..... 9- 3
9-21 Schools, New York, N. Y..... 9-10
9-21 Post-office, Little Rock, Ark..... 8-20
9-22 Post-office, Greenwood, S. C..... 8-20
9-22 Laboratory, etc., Ann Arbor, Mich..... 7-23
9-22 Bath, New York, N. Y..... 9-10
9-22 Buildings, Washington, D. C..... 9-10
9-22* Conduits, Albany, N. Y..... 9-10
9-23 Court-house, Green Bay, Wis.. 6-18
9-23* Houses, Wheeling, W. Va..... 8-27
9-23* Quarters, Ft. Hancock, N. J.... 8-27
9-24 Plumbing, Baltimore, Md..... 8-24
9-24 Quarters, Ft. Standish, Mass..... 9- 3
9-28* Post-office, Dalton, Ga..... 8-20
9-29* Post-office, Bridgeton, N. J..... 8-20
9-30 Post-office, Cape Girardeau, Mo. 8- 6
9-30 Buildings, New Orleans, La..... 9-10
10- 1* Post-office, Charlottesville, Va.. 8-20
10- 5 Post-office, Chippewa Falls, Wis. 8-27
10- 6* Vault, Washington, D. C..... 9-10
10-10 Post-office, Butte, Mont..... 8-20
10-17 Court-house, Boston, Mass..... 9-10
10-19* Post-office, Porto Rico 9- 3
11- 1 School, Wilkinburg, Pa..... 9-10

WATER-WORKS.

9-10 Water-works, Suttons Bay, Mich.. 9-10
9-11 Concrete reservoir, Franklin, Pa.. 9-10
9-11 C.-i. pipe, etc., Mt. Horeb, Wis.... 9-10
9-11 Hydrants, Portland, Ore..... 8-20
9-12 Distributing system, Pennsboro, W. Va..... 9-10
9-13* Filter cleaning apparatus, Philadelphia, Pa..... 8-20
9-14 W-wks. system, New Haven, Mo. 9- 3
9-15 Canal, Salt Lake City, Utah..... 9- 3
9-15* Reservoir, Gulfport, Miss..... 9-10
9-16 Moving boilers, New York 9-10
9-16 Hauling, laying mains, New York. 9-10
9-16* Pipe, Morenci, Ariz..... 8-13
9-16 Water system, Oxford, Ohio 9- 3
9-17 Water pipe, New York 9-10
9-17* Pumping plant, Pittsfield, Mass.. 9-10
9-19 Pumping plant, Austin, Tex..... 9- 3
9-22* W.-wks. system, Shortsville, N. Y..... 9- 3
9-22 Lime, etc., Cincinnati, Ohio..... 9- 3
9-22* Filters, Reading, Pa..... 8-27
9-23 Hydrants, New York 9-10
9-23 Brick chimneys, New York 9-10
9-23 Pumping station, Oakland, Cal.... 9-10
9-25 Machine tools, Cincinnati, O..... 9-10
10- 5 Well, Harrisonburg, La..... 8-20
10- 6* Boilers, Engines, Burlington, Ia.. 9-10
10-12* Filtration plant, Evansville, Ind. 9- 3
10-14 Cast-iron pipe, etc., Vancouver, B. C..... 8-13

SEWERS.

9-10 Sewers, Elgin, Ill..... 9-10
9-12 Sewers, Peshtigo, Wis..... 9-10
9-14 Sewers, Redondo, Cal..... 9-10
9-14* Sewer, Washington, D. C..... 8-20
9-14* Engines, Wash., D. C..... 8-13
9-14 Sewers, Steubenville, Ohio..... 9- 3
9-14* Sewers, Vicksburg, Miss..... 9- 3
9-15 Sewer, Trenton, N. J..... 9-10
9-15* Sewer, Peoria, Ill..... 8-27
9-15 Sewer, Virginia, Minn..... 9-10
9-15 Sewers, Upper Sandusky, Ohio... 9-10
9-16 Disposal, Natchitoches, La..... 9-10
9-16 Sewer, Oakland, Cal..... 9- 3
9-17 Sewers, etc., New York, N. Y.... 9-10
9-20 Sewers, Cedar Rapids, Ia..... 9-10
9-28 Sewer, Jackson, Ohio..... 9-10
9-30* Sewers, Norristown, Pa..... 9- 3

STREETS AND ROADS.

9-11 Paving, Des Moines, Ia..... 9-10
9-11 Grading, etc., Salt Lake City, U.. 9-10
9-11 Gravel road, Lafayette, Ind..... 9- 3
9-11 Gravel, Cincinnati, Ohio..... 8-27
9-11 Paving, San Francisco, Cal..... 9-10
9-12 Paving, New Albany, Ind..... 9-10
9-12 Road, Chattanooga, Tenn..... 9-10
9-12 Grading, Cleveland, Ohio 8-27
9-14* Macadam, Decatur, Ala 8-20
9-14 Gravel road, Frankfort, Ind..... 9- 3
9-14 Grading, etc., Edgewater, N. J... 9- 3
9-14 Paving, etc., New York, N. Y. 9- 3
9-14 Paving, etc., La Crosse, Wis..... 9-10
9-14 Paving, Waterford, N. Y..... 9-10
9-15 Roads, Milford, Pa..... 9-10
9-15 Paving, etc., Wilkes-Barre, Pa... 9-10
9-15 Sidewalks, Chicago, Ill..... 9-10
9-15 Gravel roads, Concord, N. H..... 9-10
9-15 Macadam, etc., Springfield, Ohio.. 9-10
9-15 Paving, etc., Lisbon, Ohio..... 9-10
9-16 Paving, etc., New York, N. Y.... 9- 3
9-16* Paving, etc., Geneseo, Ill..... 9-10
9-16 Macadam, etc., Youngstown, Ohio 9-10
9-16 Walks, etc., Washington, D. C.... 9-10
9-17 Paving, Newark, N. J..... 9-10
9-17 Stone, New York, N. Y..... 9-10
9-17 Paving, etc., New York, N. Y.... 9-10
9-18 Road, Huntington, Ind..... 8-27
9-18 Gravel road, Huntington, Ind.... 9- 3
9-18 Sidewalks, Bluffton, Ind..... 9-10
9-19 Grading, etc., Cleveland, Ohio.. 9- 3
9-20 Macadam, etc., Canton, N. C..... 9-10
9-21 Sidewalks, Canfield, Ohio..... 9- 3
9-21 Sidewalks, Ogden, Utah..... 9-10
9-21 Gravel roads, Concord, N. H.... 9-10
9-22 Alleys, St. Louis, Mo..... 9-10
9-23 Roads, Peru, Ind..... 9-10
9-25 Road, Cincinnati, Ohio 9- 3
9-28* Macadam, etc., Ft. Andrews, Mass 9- 3
9-29 Paving, Scio, Ohio..... 9-10
9-29 Gravel roads, Frankfort, Ind..... 9- 3

MISCELLANEOUS.

At once—Dredging outfit wanted, Battle Creek, Mich. 9-10
9-11 Rock removal, Boston, Mass 9-10
9-12 Moving tower, Wilmington, Del.. 9-10
9-12 Ditches, Morrison, Ill..... 9-10
9-12 Drainage, Champaign, Ill 9-10
9-12 Dam, Dayton, Ohio..... 9-10
9-12 Sale of electric railway property, Mt. Vernon, Ohio 8- 6
9-12 Rock, cement, steel, etc., San Quentin, Cal. 9- 3
9-12 Rifle range, Ottawa, Ont. 9- 3
9-14* Dredging, New York, N. Y..... 8-20
9-14 Wooden wharf, Fort Sumter, S. C. 8-27
9-14* Dredging, Norfolk, Va. 8-27
9-14 Lock gates, Winnipeg, Man..... 8-27
9-14 Steam rollers, Chicago, Ill..... 9-10
9-15 Ditch, LeRoy, Ill 9-10
9-15 Tunnel, Marshall, Colo. 9-10
9-15* Ry. grading, etc., Paterson, N. J. ..... (Elec. Rys.) 9- 3
9-15 Tile drain, Sac City, Ia 9-10
9-15 Automobile, Cincinnati, O..... 9-10
9-15 Naval supplies, Vallejo, Cal..... 9-10
9-16 Sale of tug, Boston, Mass..... 9-10
9-16 Headstones, New York 9-10
9-16 Dredging, Brooklyn, N. Y..... 9-10
9-16 Riprap wall, Oakland, Cal 9- 3
9-16 Levee, etc., Memphis, Tenn..... 8-27
9-16* Ry. work, Philadelphia, Pa..... 8-20
9-17 R. R. trestle, North Chicago, Ill.. 9- 3
9-17 Cement, planks, etc., New York.. 9-10
9-17 Iron fences, New York 9-10
9-18 Levee, New Orleans, La..... 9-10
9-18 Ditch, Salem, Neb 9-10
9-18 Steel file-cases, New York 9-10
9-21* Model cases, Wash., D. C..... 9-10
9-21 Dump cars, Panama 9-10
9-28 Electric railway, Panama..... 9-10
9-28* Elect. industrial ry., Panama..... 9- 3
9-29* Light-house, Baltimore, Md. 9- 3
9-29* Tile drains, Beardstown, Ill..... 9-10
9-30* Dredging, Norfolk, Va..... 9-10
10- 4* Dredging, excavation, Chicago, Ill. 9-10
10- 5* Rock excavation, Boston, Mass.... 9-10
10- 8 Ditch, Cerro Gordo, Ill..... 9-10
10- 9* Wharf, seawall, Mobile, Ala..... 9-10
11- 2 Submarines, Wash., D. C. 8-13
12- 1 Dredging, Hawaii 9-10

FOREIGN.

9-12 Water-works, Spain 9-10
9-12 Caisson gates, Greece 9-10
9-15 Railway, Brazil 9-10
9-22 Telegraph material, Australia..... 9-10
9-25 Tramway, Spain 9-10
9-26 Bridge, Egypt 9-10
10- 1 Railway material, Siam 7-16
10- 6 Telegraph material, Australia... 9-10
10-14 Dredging, Spain 7-16
10-14 Tramway, Roumania 9-10
10-15 Drydock, Italy 9-10
10-21 Power plant, Australia 9-10
10-29 Reservoir, pipe, India..... 8- 6
11- 2 Electric plant, Chile..... 7-16
11- 2 Telegraph material, Australia..... 9-10
11- 4 Reservoir, India 8- 6
12- 1* Sewers, paving, Ecuador..... 8- 6

CIVIL SERVICE.

9-14 Fermentation Chemist, Washington, D. C..... 9- 3
9-16 Examiner Surveys, Wash., D. C.. 9-10
9-16 Civil Engr., Philippines 9-10
9-23 Metallurgical Chemist, Watertown, Mass. 9-10
9-23 Irrigation Engr., Wash., D. C.... 9-10
9-23 Surveyor, Philippines 9-10
9-26 Draftsmen, etc., Albany, N. Y.. 9- 10
10- 7 Examiner of Accounts, Washington, D. C. 9-10
10- 7 Hydrographic Draftsman, Washington, D. C. 9-10

RAILWAYS.

BEAVER VALLEY & NORTHWESTERN.—J. M. Kerns, Sunset, Okla., Gen. Mgr. advises us that this company proposes to let contracts about Nov. 1 for building this railroad in Oklahoma from Gage, via Beaver, to Hooker, a distance of 105 miles. Surveys are made. Capital for construction and right-of-way have been obtained. H. A. Perkins is Ch. Engr., Beaver, Okla. The incorporation of this company "Oklahoma, Beaver & Western," was noted on July 2.

BOLIVIA RY.—We are officially advised that the section between Viacha and Oruro, 127 miles, has been completed and is now in operation. The general contractor is the SOUTH AMERICAN CONSTRUCTION CO., 90 West St., New York. Cost, $5,000,000. It is planned to spend $25,000,000 within the next ten years for extensions, which will include heavy construction. Rankin Johnson is Ch. Engr. of the Bolivia Ry. Co., and J. P. Hallihan is Gen. Mgr. of the South American Construction Co., both with headquarters at La Paz, Bolivia. Philip W. Henry is Pres. of the Const. Co., 35 Nassau St., New York. Noted on May 7.

BRAZIL.—Bids are asked by the Administration of Public Works and Communications (Directoria Geral de Obras e Viaçao), Rio de Janeiro, until noon, Sept. 15, for the construction of a railway from Timbó to Propriá, including the erection of buildings, the supply and installation of fixed material, supply and installation of telegraph line, supply of the rolling stock that the Government may deem necessary, and the erection of railway offices. Work is to be begun within three months after the contract is signed. Awarding of contracts will depend upon (a) the amount of the bid, (b) the period assigned for the completion of the work, and (c) the standing of the bidder. A deposit of 20,000 milreis (about $10,900) will be required to qualify and bid. Local representation is necessary.

CAZENOVIA & SAUK CITY.—We are officially informed that this company, recently incorporated in Wisconsin, will let contracts about Oct. 15 for building its proposed line from Lavelle to Cazenovia and to Sauk City, 42 miles, connecting with the Chicago, Milwaukee & St. Paul Ry. at Sauk City. Capital, $30,000. Survey is partly made. Right-of-way and capital has been obtained for first six miles. J. E. Hanslik is Secy., Cazenovia. Engineer has not been appointed yet. Previously noted.

COWETA, FRANKLIN & TROUP.—Chartered in Georgia, with $300,000 capital, to build a line 50 miles long from a point either on the Central of Georgia or the Atlanta & West Point R. R. in Coweta County to a connection with the Atlanta, Birmingham & Atlantic R. R., passing through Coweta, Heard and Troup counties. Among the incorporators are John W. Daniel, T. C. Lane, B. H. Tompkins, J. W. Ray and P. T. McCutcheon, of Franklin, Ga.; J. E. Duncan, of Lagrange, Ga.; W. C. Wright and W. A. Brannan, of Newman, Ga.

CHICAGO, MILWAUKEE & ST. PAUL.—According to newspaper reports, G. F. O'Neill, Right-of-Way Agent, Spokane, Wash., the cost of building the line from Taft, Mont., west to Saint Joe, Idaho, 60 miles, will be $190,000 a mile. There will be 35 tunnels, the longest of which will be 8,000 ft. through solid rock.

LAKE CHARLES & NORTHERN.—Bids were received by E. B. Cushing, Engr. Constr., 205 San Jacinto St., Houston, Tex., on Aug. 22 for the construction of a branch line of railroad from Gallatin to Rusk, Tex., a distance of eight miles. We are officially advised that entire grading contract was let to the SUDERMAN, BOLSEN CO., Houston. Estimated quantity, 350,000 cu. yds.

MISSISSIPPI RIVER & WESTERN.—Incorporated in Mississippi by William A. Wall, Raleigh, Miss.; A. H. Longino, Jackson, Miss.; William Connell, Lake; William H. Hughes, Raleigh; B. J. Hamrick, Hickory; S. L. Ryan, Rose Hill; Bee King, Mendenhall, and others. The application sets forth that the petitioners desire to build a line of railroad with Meridian as the terminal point on the northeast and Natchez on the southwest, and that it is their intention to traverse the counties of Lauderdale, Clarke, Jasper, Smith, Simpson, Copiah, Jefferson and Adams, and the expectation is that the line will be ready for operation within three years.

MOUNTAIN VALLEY & PLAINS.—Company has been organized under this title in New Mexico to build a line from Cimarron, N. Mex., through Amistad and Central City to Nara Visa. The work of grading will begin soon. The company is capitalized at $3,000,000, of which $130,000 has been subscribed. The incorporators are: Jay M. Cogan, Canton, Ohio; Del W. Herrington, Dalhart, Tex.; Charles J. Bushnell, Beecham, N. Y.; C. A. Macy, M. Weimer, Charles Cogan, W. A. Schuler, J. E. Buskirk, Ben O. Boyce, L. D. Chambers and H. S. Wanamaker, all of Amistad; J. S. Holland, Holland, N. Mex. The offices of the company will be at Amistad. Mr. Wanamaker is Gen. Mgr.

OREGON SHORT LINE.—Surveys are being made for a line for a railroad between Twin Falls, Idaho, and Wells, Nev. The proposed line will be about 90 miles long and will be built for the purpose of giving the districts around Twin Falls an outlet to Nevada and California. Wm. Ashton, Ch. Engr., Salt Lake City, Utah.

QUANAH & EL PASO.—Contract has been awarded by the Quanah Commercial Club to J. L. BELL, of the Kansas City & El Paso Construction Co., El Paso, Tex., to build the first section of this proposed line. The projected route is from Quanah southwest via Paducah to Carlsbad, N. Mex., thence to El Paso, Tex., about 400 miles. Right-of-way and bonus for part of the line has already been secured. Work probably will be started this year. A. B. Axtell is Ch. Engr., Quanah.

THUNDER CREEK TRANSPORTATION & SMELTING CO.—Incorporated with a capital stock of $3,000,000, to build a line from the Thunder Creek mining district in Skagit and Whatcom Counties, Wash., to a connection on the Great Northern Ry. A. M. Richards is Pres., Tacoma, Wash.; W. W. Shenk, F. S. Blattner and Charles E. Phoenix, of Seattle, and George Senior, of Bellingham, are Directors.

TEXAS.—Pleasanton, (Tex.) has offered a bonus of $50,000 to secure the building of a railroad to this city. It is desired to have the road extend from San Antonio via Atascosa to Pleasanton, 30 miles. George M. Martin, of Pleasanton, is interested.

S. N. Dorsett, Secy. of the Rockport (Tex.) Board of Trade, states that $30,000 in cash and right-of-way through Aransas County and depot grounds in Rockport are offered to the first acceptable railroad now operating 200 miles of road in Texas which builds in from the North. The road accepting the offer must construct a modern passenger depot in the city. S. Lightbourne is Pres. of the Board.

WACO, HAMILTON & BROWNWOOD.—Stephen Turner, Ch. Engr., Waco, Tex., informs us that prospects are good for resuming construction in a few months. This railroad will be about 132 miles in length, connecting Waco and Brownwood, Tex. Preliminary survey has been made. Capital and right-of-way have not been secured. Date for letting contracts not yet decided. J. B. Baker, Waco, is Pres.

ELECTRIC RAILWAYS.

ANSONIA, CONN.—The Board of Aldermen has granted the Connecticut Company an extension of time to Nov. 1, 1909, for double-tracking its line in Ansonia.

PHILADELPHIA, PA.—An ordinance providing for an increase of the city's indebtedness $4,000,000, with which to build an elevated railroad from Front and Market Sts. to the Torresdale Boulevard has been introduced in Select Council by James Emory Byram, of the 23d Ward, Frankford. The bill was referred to the Street Railway Committee. It is provided that the city shall lease the road to the highest bidder. Funds with which the city is to build the road are to be obtained by increasing the indebtedness by $4,000,000, the loan proposition to be submitted to a vote of the people. The line would be 7¼ miles long.

EDGEFIELD, S. C.—The Augusta & Edgefield Elec. R. R. Co. will let contracts for grading, track laying, bridges, etc., as soon as the surveys are completed and officers of the company are elected. The permanent organization of the company will probably be effected soon. There will be two bridges on the line. W. P. Calhoun is Chn. Noted on Aug. 20.

FAIRBURN, GA.—A plan is under way to organize a local company to build an electric street railway from Fairburn to College Park. A mass meeting was held recently when the project was discussed and the following committee appointed to secure a right-of-way and solicit subscriptions: Dr. L. M. Hobgood, W. A. McCurry, C. B. Dorris and B. F. Jones, of Fairburn; J. F. Hemperley, of Union City; F. M. Scarbrough and W. B. Trentham, of Stonewall; H. C. Williams, of Red Oak; H. H. Camp, of College Park. It is proposed to capitalize the company at $50,000.

SANFORD, FLA.—The Sanford Traction Co. has made application for a franchise to operate a street railway in Sanford. The incorporators are S. O. Chase, A. T. Rossiter, A. P. Connolly, F. P. Forster and J. N. Whitner.

ERWIN, TENN.—The Unaka Traction Co. has been chartered to build a railway from Erwin to Johnson City, Tenn., via Unaka Springs. The line may use practically any motive power. It will cut through Washington, Unicoi and Carter Counties. The incorporators are Isaac R. Love, W. B. McNabb, A. M. White, F. B. Vines and J. A. Wilson, of Knoxville.

BRIDGEPORT, OHIO.—The Wheeling, Cadiz & Tuscarawas Traction Co., of Cadiz, with $10,000 capital stock, has been incorporated to build an electric railway to run from Bridgeport to Uhrichsville. The incorporators are Barclay W. Rowland, Charles S. Scott, Charles F. Branson, William T. Perry, John F. Kennedy and G. W. Grissinger, of Wheeling, W. Va.

TOLEDO, OHIO.—The Toledo, Ann Arbor & Detroit R. R. is to be offered for sale by order of the special master in chancery under mortgage foreclosure decree, on Oct. 12 at 11 a. m. in front of the court-house in Monroe, Mich. Willis Baldwin, Receiver, at Monroe. The line is completed for 17 miles.

ZANESVILLE, OHIO.—The Zanesville & Meigs Valley Traction Co. has been organized to construct an electric railway from Zanesville to Beverly, Ohio, via McConnelsville. The company has practically 50 per cent. of its right-of-way under option and the balance will be closed shortly, it is announced. Capital, stock, $10,000. Officers: E. R. Meyer, Zanesville, Pres.; C. T. Gale, Blue Rock, Ohio, Vice-Pres.; F. M. Cruise, Zanesville, Secy.; A. J. Longstreth, Zanesville, Treas.; H. D. Blodgett, Zanesville, Gen. Mgr. Headquarters, Zanesville.

FERDINAND, IND.—The Ferdinand R. R. Co. probably will begin construction work next month on the electric railway projected between Huntingburg and Ferdinand, Ind., seven miles. Capital stock, $50,000. Headquarters, 617 Terminal Bldg., Indianapolis, Ind. Officers: O. W. Blickenstaff, Pres.; C. M. C. Shanks, Vice-Pres.; D. H. Morgan, Secy.; N. P. Carter, Treas.; H. E. Huntington, Gen. Mgr.; C. A. Morgan, Electrical Engr.; Will Duncan, Ch. Engr. Noted on Aug. 27.

EVANSVILLE, IND.—The Evansville & Eastern Railway Co., a sub-corporation of the Evansville & Eastern Electric Railway Co., has made application for a charter. It will be constructed from Rockport to New Albany and from there across the river to Louisville, Ky., and will be the longest interurban in Southern Indiana. A. W. Funkhouser, Atty., Evansville, states that it will be built immediately from Rockport to Grandview, a short distance in which subsidies have already been voted. Subsidies have been assured from Grandview to Tell City.

JANESVILLE, WIS.—The Cincinnati Construction Co. is now completing the final surveys for its proposed electric railway which is to connect Janesville, Edgerton, Stoughton, Lake Kegonsa, Lake Waubesa and Madison. H. H. Zigler, Columbus, Ohio, is Pres., and Joseph Ellis, Janesville, Wis., Mgr. and Ch. Engr. Noted on Aug. 13.

ALBIA, IOWA.—Contract has been given to PATRICK FITZGERALD, of Atlantic, Iowa, to build an extension of the Albia Interurban Ry. from Albia, Iowa, northwest, about six miles, to Hiteman.

EL PASO, TEX.—We are officially advised that the Mesilla Valley & El Paso Ry. Co., organized in El Paso, will construct an electric railway between El Paso and Las Cruces, N. Mex., about 47 miles. Capital stock, $1,000,000. Company has not been incorporated or organized yet. Noted on July 23.

MIAMI, OKLA.—The Oklahoma, Missouri & Kansas Interurban Ry. Co. has been organized here with a capital stock of $100,000. D. W. Cooter, Franklin M. Smith, John Hall, R. H. Holton and F. O. Freeman are the incorporators. They propose to build a line from Miami to Lincolnville. Franklin Smith, is Pres., Joplin, Mo.

MARSHFIELD, ORE.—The Coos Bay Ry. & Terminal Co. has commenced active construction work on its standard-gage railway which is to link Empire City, North Bend, Marshfield and Eastside. The system will comprise about ten miles of line. The company plans to operate nine cars. The overhead trolley system will be adopted, current being obtained from the Coos Bay Gas & Electric Co., which is owned by the railway company. Repair shops will be located at North Bend, Ore. Headquarters, Marshfield. Capital stock, $250,000. Officers: Henry Hewitt, Jr., 517 Provident Block, Tacoma, Wash., Pres.; L. J. Simpson, North Bend, Ore., Vice-Pres.; J. J. Hewitt, Tacoma, Wash., Secy.; Seymour H. Bell, Marshfield, Treas. and Gen. Mgr. Incorporated Aug. 13, 1908. Noted on Aug. 13.

MILNER, IDAHO.—D. C. MacWatters, Pres. of the Milner & North Side Elec. R. R. Co., at Milner, announces that this line will be completed to Wendell by Oct. 15. The grading has been finished up to a point south of Gooding. Another grading outfit is working out of Milner toward Jerome. As officially noted on Jan. 30, 1908: "The proposed line will run from Milner in a northwesterly direction through Jerome and Wendell to the Oregon Short Line at a point near Gooding, about 65 miles long. Surveys are made and capital and right-of-way are secured. A few small grading contracts have been let. The railroad will be built through a large irrigation project on north side of Snake River. A bonus per acre has been allowed by the State of Idaho to this company for building the line." D. C. MacWatters, Milner, is Pres.; P. S. A. Bickel, Milner, is Ch. Engr.

DUNNVILLE, ONT.—We are officially advised that the Dunnville, Wellandport & Beamsville Elec. Ry. Co. will let construction contracts about Sept. 25. Plans, etc., are at office of Geo. Dunston, 43 Scott St., Toronto, Ont., who is handling the project. The line will be about 23 miles long and will connect Dunnville, Wellandport and Beamsville, across the Niagara peninsula from Lake Erie to Lake Ontario. Surveys are made. Right-of-way is partly secured. James A. Ross, Wellandport, Ont., is Pres.; R. T. Gough is Ch. Engr., Bank British North America Bldg., Toronto. Noted on March 12.

PANAMA.—Bids are asked until Sept. 28 by the Isthmian Canal Commission for the construction of one complete electric industrial railway. Full particulars are given under U. S. Possessions and Cuba.

LIGHT AND POWER PLANTS.

(denotes that this work is advertised in Engineering News.)*

LEOMINSTER, MASS.—The Connecticut River Power Co. has petitioned the Selectmen for permission to erect poles for a transmission line across the public highways. The wires are to be strung from poles or towers located on private property and to cross the highways at a height not less than 25 ft. Albertus W. Jackson is Supt. of Sts.

*BOSTON, MASS.—Bids are asked until noon, Oct. 8, by Lieut.-Col. Burr, Corps Engrs., U. S. A., Boston, for furnishing and delivering electrical junction boxes and cable.

STONINGTON, CONN.—The contract for building the addition to the power-house at the American Velvet Co. mill has been awarded to SHERMAN & SONS. The addition is to be used for holding the new electrical apparatus which is to be installed.

*DANIELSON, CONN.—Bids are asked by E. Worthington, Dodham, Mass., Engr. Danielson Cotton Co., Danielson, Conn., until Sept. 15 for constructing a masonry dam and power-house foundations on the Quinebaug River in Killingly and Pomfaret, Conn., for the Danielsonville Cotton Co.

NEW YORK, N. Y.—Bids are asked until 3 p. m., Sept. 17, by the Park Board, Henry Smith, Pres., for furnishing the American Museum of Natural History with seven electric motor and electric cables.

The following bids were opened on Sept. 1, by James Knox Taylor, Supervy. Arch., Treasury Dept., Washington, D. C., for electrical work in the U. S. post-office, New York: Lee & Bellmer Co., 50 West Broadway, New York, $5,582; time, Oct. 20. Cortlandt Engineering Co., 39 Cortlandt St., New York, $4,990; Nov. 3. Reis & Donovan, 1123 Broadway, New York, $3,269; Nov. 2. McLeod, Ward & Co., 27 Thames St., New York, $3,200; Dec. 31. M. B. Foster Electric Co., 27 West 27th St., New York, $3,490; Nov. 1. Fred Pearce Co., 20 Rose St., New York, $4,130; Nov. 28.

BOONSBORO, MD.—The Antietam Electric Light & Power Co. has engaged Orville Shiffler, Arch., of Hagerstown, Md., to prepare plans for its power plant, to be located on Antietam Creek. The company was awarded a contract recently to furnish the city with electricity for lamps for a term of ten years. H. L. Moser is Secy.

DANVILLE, VA.—The city has appropriated $22,000 for a central lighting plant. Improvements will consist of additional boiler, 500-KW. steam turbine generator, etc. Frank Talbott is Supt. Water, Gas and Electric Dept.

BRIDGEWATER, VA.—J. S. Dovel, of Bridgewater, and Charles W. Bowman have purchased and will develop the Grattan water power on the North River; capacity 150 HP.

*WHEELING, W. VA.—We are officially advised that bids were received as follows Aug. 31, by Capt. F. W. Altstaetter, Corps Engrs., U. S. A., for building a power-house at Dam No. 13, Ohio River: W. Bateson & Co., Wheeling, $20,148, 200 days; the W. W. Wood Co., Wheeling, $20,512, 180 days; C. L. Mohney & Co., Petersburg, Pa., $20,820.

GASTONIA, N. C.—The contract for the electrical machinery with which to equip the Loray Mills of Gastonia so that they may change from the steam to the electric drive has been let to the WESTERN ELECTRIC CO., 463 West St., New York. The equipment calls for about 3,000 HP. and will cost in the aggregate between $60,000 and $65,000. The machinery will be placed in about 60 days and the mill will be ready to connect up in about three months.

CHARLOTTE, N. C.—We are officially advised that the Southern Power Co., of Charlotte, has awarded contract to the Receivers of MILLIKEN BROS., INC., 11 Broadway, New York, for furnishing a number of steel towers. F. P. Rosamond, Great Falls, S. C., is Supt.

BIRMINGHAM, ALA.—The town of North Birmingham, Ala., will build a water and light plant to furnish the city of Greater Birmingham, Ala., of which North Birmingham will become a part in 1909, with water and electric lights. Construction probably will be begun in January of next year. The water plant will supply 30,000,000 gallons of water per day and the light plant 20,000 KW. Both plants will be operated by water power and the site upon which they are to be erected is about 30 miles from Birmingham. W. C. Harkins is Clerk and Treas. of North Birmingham.

CANTON, OHIO.—Improvements and extensions are to be made by the East Ohio Gas Co. to its mains. Work has been started on a 14-in. main, 50 miles to Youngstown, via Alliance. From a point near Fairlawn, northwest of Akron, an 18-mile branch is to be laid east to Cuyahoga Falls, Ravenna and Kent. Both jobs are to be completed by the middle of October. J. J. McMahon, Canton, is Main Line Supt.

MINERVA, OHIO.—Bids will be received until 7 p. m., Sept. 24, by L. E. Weber, Secy. Bd. Pub. Service, for a 150-HP. boiler, 150 lbs. steam pressure, for the municipal electric light and water plant. A. A. Bates is Supt.

COLUMBUS BARRACKS (Columbus post-office), OHIO.—Bids will be received until 10 a. m., Sept. 15, by Capt. H. J. Hirsch, Constr. Q. M., U. S. A., Columbus Barracks, for furnishing and installing electric light fixtures, meters, etc., and making service connections to post hospital at this post for lighting.

CINCINNATI, OHIO.—Tietig & Lee, Archs., Commercial Tribune Bldg., Cincinnati, have let general contract to the CONCRETE STEEL CONSTRUCTION CO., Century Bldg., for a power-house to be built in this city, for A. L. Andrews, Covington, Ky. Cost, $85,000.

SAGINAW, MICH.—The Commonwealth Power Co., of Jackson, Mich., which is connected with a project for development of the water power of Au Sable River to furnish the Saginaw Valley with electricity, has begun operations testing the soil where the lake of backwater will be created and where the dams will be erected. A series of dams is to be built at intervals of ten miles. The first will be near Banfield and will be 40 ft. high. The company has secured flowage rights along the entire river where backwater will cover the land. Negotiations for right-of-way for power lines between Au Sable and the valley cities are under way. J. B. Foote is Gen. Supt. and Ch. Electrician, Jackson.

MORLEY, MICH.—E. W. Bending, of Grand Rapids, Mich., and Joseph Bicknell, of Muskegon, Mich., have begun work on the power dam on the Little Muskegon River at Morley. The headquarters of the company which will operate the power plant to be erected will be at Morley and power will be provided for the surrounding towns.

CUMBERLAND, WIS.—Bids will be received until Sept. 14 by A. E. Wright, City Clerk, for improvements and additions to the water-works and electric light plant. Oscar Claussen, German-American Bank Bldg., St. Paul, Minn., Engr.

THORP, WIS.—Bids will be received by W. S. Parks, Village Clerk, until Sept. 12, for the construction of a second story on the power-house.

HARTLEY, IOWA.—Bids will be received until Sept. 24 by the Town Clerk for installing an electric light plant, consisting of a gas producer, gas engine, dynamo, switchboard, storage battery and pole lines. E. B. Rich., Engr., Fort Dodge,

CLARKFIELD, MINN.—The Clarkfield Roller Mills & Electric Light Co., of Clarkfield, Minn., has let contract to the MINNEAPOLIS STEEL & MACHINERY CO., 28th and Minnehaha Sts., Minneapolis, for an 80-HP. Muenzel producer gas engine and suction gas producer for running their mill and electric light plant.

ST. MARYS, KAN.—On Aug. 11 the citizens voted to issue $15,000 bonds for the construction of an electric light plant. Burns & McDonnell, of Kansas City, Mo., are Engrs. Henry Mees is City Clerk.

EL PASO, TEX.—The New Mexico Power Co. intends to develop 2,000 HP., to be used in this city. This company has acquired about 4½ miles of the land along the Penasco River, southeast of Cloudcroft, and the water from this river will be diverted by a dam to Cox Canyon. From the lake thus formed the water will be taken in a ditch along the foothills to a power plant about three miles from Mayhill, about 18 miles southeast of Cloudcroft. From the power plant it is planned to carry the current to Jarilla and down along the Rock Island to Alamogordo, Orogrande and this city, where it will be utilized for power. It is estimated that the entire plant will cost about $500,000. E. Krause and W. E. Fletcher are owners, El Paso.

AUSTIN, TEX.—Bids are asked until Sept. 19, by Water, Light and Power Commissioners for the construction of a concrete steel addition to the municipal pumping station, approximately 89 × 64 × 35 ft. Walter G. Kirkpatrick is Engr., Jackson, Miss.

RATON, N. MEX.—The Southern Colorado Power Co. will develop power in Raton and Colfax Counties. H. M. Seigfried is Gen. Mgr.

SANTA FE, N. MEX.—Application has been made by J. P. Connor, of this city, to the Territorial Engineer, for the waters of the Pacos River, 20 miles east of Santa Fe, for the development of 4,000 HP. for a power plant that is to supply Santa Fe, Las Vegas, Albuquerque and the Estanvia Valley with electric power. It is proposed to put up a $200,000 power plant on the river.

OCEANSIDE, CAL.—A. Gensline, 1315½ West Twelfth St., Los Angeles, Cal., contemplates building a gas plant.

OAKLAND, CAL.—The Board of Works has issued a permit to the Oakland Gas, Light & Heat Co. to construct a $35,000 building on First St., between Grove and Jefferson Sts. This building will contain the new turbine engines, burning crude oil, and new auxiliary electric plant, which will be used when heavy loads are carried or in case of emergency. Other improvements are said to be contemplated by the company, including new mains, the establishment of [illegible] electric lines, etc. F. A. Leach, [illegible] Mgr.

PHOENIX, ARIZ.—Bids are [illegible] W. Goodman, Supt. Indian [illegible] until 2 p. m., Sept. 30, for [illegible] ering and setting up in place [illegible] two 125-HP. boilers, two oil [illegible] water heater, one duplex [illegible] smokestack and one electric [illegible] dian School.

OGDEN, UTAH.—The [illegible] plant to be built at Ogden [illegible] $125,000. Nothing will be [illegible] of construction until March [illegible] Spencer, P. O. Box 499, Ogden.

PORT ARTHUR, ONT.—The [illegible] B. Smith, Engr., Confederat[illegible] Toronto, Ont., for a power [illegible] $40,000 have been rejected and [illegible] decided to accept plans prepared [illegible] Smith for an $8,000 structure. [illegible] City Clerk.

SAULT STE. MARIE, ONT. [illegible] being considered for the reconstruction of the power plant of the Tagona Light Co., which was destroyed by fire in May. J. S. Wynn is Acting Mgr.

TORONTO, ONT.—We are officially advised that Smith, Kerry & Chace, Eastern Confederation Life Bldg., Toronto, have been retained by the F. H. McGUIGAN CONSTRUCTION CO., contractor, to supervise the construction of the Hydro-Electric Commission's proposed transmission line, 250 miles long, to cost $1,270,000.

*TORONTO, ONT.—Bids are asked until 6 p. m., Sept. 28, by Hon. Adam Beck, Chn. Hydro-Power Comn. of Ontario, Toronto, Ont., for the supply and erection of 22,000-volt single-phase or 110,000-volt 3-phase transformers for operation on the Commission's 110,000-volt transmission system; also for the manufacture, supply and erection, complete, of the switching and indicating apparatus for the 110,000-volt transformer stations. Apparatus is required for the following high-tension transformer stations: Niagara Falls step-up transformer station, Toronto, London, Dundas, Guelph, Preston, Berlin, Stratford, St. Mary's, Woodstock, Brantford, and St. Thomas step-down transformer stations, all according to plans and specifications to be obtained at the Commission's office, Continental Life Building, Toronto.

BRIDGES.

(denotes that this work is advertised in Engineering News.)*

*RUSSELL, MASS.—We are officially advised that bids were received as follows on Sept. 1 by the Bridge Committee for the superstructure of a bridge over the Westfield River here: LEWIS F. SHOEMAKER & CO., Harrison Bldg., Philadelphia, Pa., $11,905 (awarded contract); Boston Bridge Works, Boston, Mass., $12,791; Berlin Construction Co., Berlin Co., $12,350; King Bridge Co., Cleveland, Ohio, $13,079; Phoenix Bridge Co., Boston, Mass., $13,146; Penn Bridge Co., Beaver Falls, Pa., $13,500; United Construction Co., Albany, N. Y., $14,285; N. E. Structural Co., Boston, Mass., $14,365; Eastern Bridge & Structural Co., Worcester, Mass., $14,380; H. P. Converse & Co., Boston, Mass., $14,700; S. W. Bowles Co., New York, $14,899; Canton Bridge Co., Albany, N. Y., $14,971. Oren E. Parks, Westfield, Mass., is Engr.

WOONSOCKET, R. I.—The contract for constructing a reinforced-concrete bridge on Sayles St. has been awarded by the city to SCHEUERMANN & PECK, of Albany, N. Y. Frank H. Mills is City Engr.

BRIDGEPORT, CONN.—Bids will probably be asked the latter part of this month for the construction of the bridge over Pequonnock River at Congress St. The bridge will have Scherzer type of draw, double lift, of reinforced concrete, with four spans and approaches. Estimated cost, $250,000. R. F. Stoddard, of Bridgeport, is Engr.

ALBANY, N. Y.—Bids are asked by F. C. Stevens, Supt. Pub. Wks., Albany, until noon, Oct. 1, for the construction of five steel superstructures for highway bridges.

VENTNOR CITY (South Atlantic City post-office), N. J.—We are officially advised that the Board of Freeholders awarded the contract on Sept. 2 for the construction of the bridge across Inside Thoroughfare at Dorset Place, to the NELSON MEREDITH CO., of Atlantic City, N. J., at $28,250. Other bidders were: B. F. Sweeten & Co., $34,000; A. E. Sanford Co., $28,950; Owego Bridge Co., $34,495; P. E. Lane, $32,450; Atlantic Construction & Supply Co., $55,520.

NEWTON, N. J.—The Board of Chosen Freeholders on Aug. 25 awarded the contract for constructing a bridge over the River Styx in Byram Township to the CANTON BRIDGE CO., of Canton, Ohio, at $10,285.

MEDIA, PA.—The contract for constructing the bridge over Cobbs Creek, at Woodland Ave. between Delaware and Philadelphia Counties, has been awarded to the AMERICAN PAVING & CONSTRUCTION CO., 211 South Ninth St., Philadelphia, Pa., at $19,300.

PITTSBURG, PA.—Bids are asked until Sept. 11 by F. P. Booth, County Controller, Pittsburg, for constructing two reinforced-concrete bridges, known as bridge No. 2, Brush Run, and bridge No. 3, Plum Creek; also for repairing certain bridges.

*READING, PA.—Bids are asked until 10 a. m., Sept. 18, by A. L. Rhoads, County Controller, for a reinforced-concrete arch bridge in the Township of Robeson, Berks County, to be known as Trap Rock bridge, to be erected over Hay Creek at a point where the public road leading from Birdsboro to Trap Rock crosses the creek. Plans and specifications can be obtained at the office of the County Commissioners, Reading.

HOKENDAUQUA, PA.—Bids are asked until Sept. 11 by the Commissioners of Lehigh and Northampton Counties to be opened at the office of the Commissioners of Lehigh County, Allentown, for the repairing, alter-

ations and additions, of a combination highway and trolley bridge over the main line of the Lehigh Valley R. R. at Hokendauqua. Bids will be received according to Plans "A" and "B" as follows: Plan "A": Furnishing and erecting a Warren trussed steel combination highway and trolley bridge with reinforced-concrete floor paved with vitrified brick, having a clear span of 80 ft. and a roadway of 24 ft. 6 ins. from center to center of trusses, with the lower chord encased in concrete on a substructure furnished to the contractor ready to receive the superstructure; plan "B": The same except the span, which is to be 58 ft.

HARRISBURG, PA.—We are officially advised that the FERRO-CONCRETE CO., of Harrisburg, has been awarded the contract by W. W. Caldwell, Highway Comr., for the construction of a reinforced-concrete bridge over Paxton Creek at $4,449. Bids were opened on Aug. 29.

FRANKLIN, PA.—Bids are asked until 1 p. m., Sept. 16, by the Commissioners of Venango County for the construction of a highway bridge over Stewart's Run. E. K. Smiley is Clk. Comrs.

TOWSON, MD.—HARRY T. CAMPBELL has been awarded the contract at following bid for excavating and bridge work on Taylor Ave., for the county: Excavation, 32 cts. per cu. yds.; $9 per cu. yd. for reinforced concrete and $4.50 per cu. yd. for plain concrete.

SPARTANBURG, S. C.—W. Frank West, County Superv., has awarded the contract at $5,100 to A. D. McCLAIN, Spartanburg, for the construction of three steel bridges. Bids were opened on Aug. 22.

HANDSBORO, MISS.—The city has voted $6,500 of bonds for the construction of a bridge across Bayou Bernard.

STANFORD, KY.—Bids are asked until Oct. 1 by G. B. Cooper, Clk. Committee Lincoln County Fiscal Court, Stanford, for an iron or steel bridge, two spans, each 32 ft. long, 16 ft. wide, across Hanging Fork Creek on the Stanford and Hustonville Pike.

MT. GILEAD, OHIO.—Bids are asked until Sept. 17, by W. C. McFarland, County Audr., for constructing the Fate bridge in Canaan Township, 60 ft. span and 14 ft. roadway.

CLEVELAND, OHIO.—Bids are asked until 11 a. m., Sept. 30, by the County Commissioners for the construction of a concrete bridge, Lee road, Bedford Township, and a concrete culvert, Canal road, Newburg Township. W. F. Black is Clk. Comrs.

CLEVELAND, OHIO.—Bids are asked by the County Commissioners until 11 a. m., Sept. 26, for the construction of bridge work. William F. Black is Clk.

SPRINGFIELD, OHIO.—The following bids were opened on Aug. 25 by Board of Public Service for constructing a concrete bridge over Buck Creek at Nelson St. and Sherman Ave.: National Bridge Co., of Indianapolis, Ind., (four bids), $28,280, $28,500, $29,780 and $30,000; Van Name & Co., of New York, N. Y., (two bids), $34,500 and $34,900; W. W. Luyster, of Dayton, (four bids), $28,743, $30,223, $31,287 and $31,831; A. J. Yawger & Co., of Indianapolis, Ind., (two bids), $27,997 and $30,798; KEPPLE, HALL & CO., of Dayton, (four bids), $27,330, $28,330, $28,930 and $29,930 (awarded contract).

The County Commissioners have awarded contracts for constructing the Geeting bridge in the northwestern part of Pike Township as follows: HOME ENGINEERING & CONSTRUCTION CO., of Canton, Ohio, for superstructure, $11,387; for substructure, CHAS. BIRD, at $5.95 per cu. yd.

CINCINNATI, OHIO.—Bids are asked until Sept. 25 by the County Commissioners, Cincinnati, Fred. Dreihs, Clk., for constructing a bridge over the south fork of Taylor's Creek in Green Township, according to specifications 785.

*CINCINNATI, OHIO.—Bids are asked until noon, Oct. 1, by the Board of Public Service for furnishing the necessary labor and materials for the improvement of Eighth St. viaduct, superstructure work including all structural steel, street railway tracks and poles, reinforcing bars for concrete, roadway pavements, concrete under roadway pavements, and reinforced cement concrete sidewalks complete, according to plans and specifications on file at the office of the Board and the office of the Chief Engr. John J. Wenner is Clk Bd.

PIQUA, OHIO.—Bids are asked until Sept. 21 by E. E. Pearson, County Audr., Troy, Ohio, for furnishing material and constructing a reinforced-concrete or steel bridge at South St., Piqua, to have 26-ft. roadway, 27-ft. span, 150-lb. live load capacity.

MT. VERNON, OHIO.—Bids are asked until Sept. 21 by C. A. Mitchell, County Audr., Mt. Vernon, for constructing the substructure of a bridge in Howard Township, Knox County, known as the Allen bridge.

PHILO, OHIO.—Bids are asked until noon, Sept. 28, by the County Commissioners for furnishing all the material and performing all the labor or part thereof for the construction of a concrete abutment at the west end of the river swing bridge at Philo. L. E. Breisford is County Audr.

ST. CLAIRSVILLE, OHIO.—Bids are asked until 1 p. m., Sept. 28, by A. W. Beatty, County Audr., for bridge work.

VALPARAISO, IND.—The Commissioners of Porter and Jasper counties will soon ask for bids for the construction of a joint bridge over the Kankakee River, which forms the boundary line.

SOUTH BEND, IND.—The Commissioners of St. Joe County will ask for bids for the construction of a bridge over Potato Creek in Liberty Township as soon as plans are completed. A. J. Hammond is Engr.

CHAMPAIGN, ILL.—The ELKHART BRIDGE CO., Elkhart, Ind., has been awarded the contract at $5,013 for a 144 ×

AURORA, ILL.—The ROEMHELD CONSTRUCTION CO., 171 La Salle St., Chicago, 14-ft. iron bridge over the Sangamon River in Newcomb Township, Ill., has been awarded the contract at $35,882 for the east bridge over Fox River, and $31,733 for the west bridge.

*CHICAGO, ILL.—Bids were received as follows by the Sanitary District of Chicago on Sept. 2 for the following work: (A) for supplying all materials and labor, excepting for electrical work and interlocking, necessary for the equipment of the eight-track bridge for the Pittsburg, Cincinnati, Chicago & St. Louis Ry. Co., the Chicago Terminal Transfer R. R. Co. and the Chicago Junction Ry. Co., crossing the main drainage channel; (B) for the removal of the existing channel spans of this bridge over the main drainage channel and for the construction of new single leaf channel spans and supplying the necessary machinery and electrical equipment therefor; (C) amount contractor will pay Sanitary District for old material: Modern Steel Structural Co., Waukesha, Wis., $358,189; (B) $424,117; (C) $5,812. Kettler-Elliott Erection Co., Chicago, (A) $392,917; (B) $443,154; (C) $14,300. Strobel Steel Construction Co., Chicago, (A) $408,690; (B) $462,644; (C) $8,500. John J. Fanning & Co., Chicago, (A) $415,002; (B) $458,070; (C) $16,560. Pennsylvania Steel Co., Steelton, Pa., (A) $459,680; (B) $460,090; (C) $10,000. Chicago Bridge & Iron Works, Chicago, (B) $430,647; (C) $17,000. Riter-Conley Mfg. Co., Pittsburg, (B) $432,017; (C) $14,500. Roemheld Construction Co., Chicago, (B) $435,974; (C) $10,000. King Bridge Co., Cleveland, (B) $459,467; (C) $12,000.

WILLISTON, N. DAK.—Bids are asked until 10 a. m., Sept. 15, by E. M. Atterberry, County Audr., for constructing either a steel bridge with reinforced-concrete abutment and concrete floor, or an all reinforced-concrete bridge over Long Creek, the bridge to be 40 ft. long, 16 ft. roadway and 10 ft. above water line. Plans and specifications are to be furnished by bidders.

*MISSOULA, MONT.—O. E. PEPPARD was awarded the contract on Aug. 25 for the construction of a temporary foot and wagon bridge across the Missoula River at $4,376. The bridge will be a 2-span structure, with a total length of 460 ft. Each of the spans will be 80 ft. in length and the remainder of the passageway will be planking across the island. The bridge will be 25 ft. wide, with a 5-ft. walk in the center.

ELECTRIC, MONT.—The MINNEAPOLIS STEEL & MACHINERY CO. was awarded the contract on Aug. 26 for the construction of a steel bridge across the Yellowstone River here, at $13,300.

*AUSTIN, TEX.—Plans and specifications are asked until noon, Oct. 5, by the Commissioners Court of Travis County, for the construction of a reinforced-concrete bridge of the most modern type, across the Colorado River at Congress Ave. John W. Hornsby is County Judge.

SPOKANE, WASH.—Bids were received as follows on Aug. 25 by the Board of Public Works for the construction of (a) bridge at North Howard St., (b) steel bridge at East Olive Ave.: (a) Daniel Boyington, $53,000; Huetter & Zirngibl, $54,590; George Cooke & Sons, $54,800; Julia V. Costello, $63,700; M. C. Murphy, $68,900; engineer's estimate, $55,000. (b) Burrell Bridge & Construction Co., Oakland, Cal., $59,000; Charles G. Sheely, Denver, Colo., $63,242 (bid rejected because check of certification was not drawn on a Spokane bank); Huetter & Zirngibl, $69,800; Minneapolis Steel & Machinery Co., $79,681; Morava Construction Co., Chicago, $3.85 a lb., f. o. b. (bid not made in conformity with the requirements); engineer's estimate, $80,000. J. C. Ralston is City Engr.

LOS ANGELES, CAL.—Bids are asked by the Board of Public Works until Sept. 14, for constructing a reinforced-concrete bridge across the Los Angeles River at Main St.

MARYSVILLE, CAL.—The WESTERN BRIDGE & CONSTRUCTION CO. has been awarded contracts at $3,525 for substructure and $3,150 for concrete abutments, for the county bridge over Simmerly Slough.

POST FALLS, IDAHO.—Bids are asked until Sept. 17 by the County Commissioners, Rathdrum, Idaho, for constructing a steel bridge over the Spokane River here. Estimated cost, about $12,000.

L'ORIGNAL, ONT.—Bids are asked until Oct. 6 by E. Abbott Johnson, County Clk., L'Orignal, for constructing an iron highway bridge over the Big Castor River, 115 ft. span; also separate bids for the concrete or stone masonry work in connection with the bridge.

OTTAWA, ONT.—THOMAS McLAUGHLIN has secured the contract for filling in and abutment work required for widening the Somerset St. bridge 16 ft., and the DOMINION BRIDGE CO., the contract for the steel work. Total cost, $14,000.

TORONTO, ONT.—The Department of Public Works has awarded the contract for constructing a bridge over the Blanche River in the District of Temiskaming, to SINCLAIR & SMITH, of New Liskeard, Ont., at about $5,000.

KINCARDINE, ONT.—The Township Council has awarded the contract for constructing a reinforced-concrete bridge flat arch, 25-ft. span, over the river on the seventh concession of the township of Kincardine, to C. S. WOOD, of Bruce, Tiverton.

The contract for constructing two reinforced-concrete flat arch bridges, one on the fourth concession of Bruce and one on the sixth concession of Bruce, near Underwood, has also been awarded to MR. WOOD.

WESTVILLE, N. S.—McNEIL BROS. have been awarded contracts for bridge work as follows: One 80-ft. span over the Segas River; one span over Green River; one span over Grand River; one span over Baker River, and one span over Four-Mile Brook. The latter is a 13-deck girder, spans carried on six towers, 60 ft. high.

EGYPT.—See item under Foreign Contracts.

BUILDINGS.

(* *denotes that this work is advertised in Engineering News.*)

BAR HARBOR, ME.—Walter Ladd, of Pasadena, Cal., will build a cottage at Bar Harbor, it is reported. Mr. Ladd recently purchased on the Carniece Drive land formerly owned by the Haight estate.

PORTSMOUTH, N. H.—Bids were received as follows on Sept. 5, at the office of the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for the construction of an extension to the naval prison at Portsmouth, N. H. (A) on Government specifications; (B) on bidder's alternate specifications: Westinghouse, Church, Kerr & Co., 10 Bridge St., New York, (A) $55,100, (B) $51,780, $51,-060; Abenthaw Construction Co., 8 Beacon St., Boston, (A) $57,250, (B) $49,190; Conners Bros. Co., Lowell, Mass., (A) $56,500; James E. Learny & Co., Syracuse, N. Y., (A) $55,125; G. & W. Mfg. Co., 26 Cortlandt St., New York, (A) $69,913; Arthur P. Knapp, Lowell, Mass., (A) $48,532; C. M. Leach, care Navy Yard, Boston, Mass., (A) $55,555, (B) $54,983; Snare & Triest Co., 143 Liberty St., New York, (A) $53,520.

BOSTON, MASS.—Bids are asked until noon, Oct. 17, by the Commissioners for the Enlargement of Suffolk County Court-House, at the office of James R. Dunbar, Comr., Ames Bldg., Boston, for constructing an addition to said court-house. George A. Clough, 46 Cornhill, Boston, is Arch.

TROY, N. Y.—M. F. Cummings & Sons, Archs., 510 State Bank Bldg., Troy, have been retained to prepare plans for a school building to be erected at Sixth St. and Ingalls Ave., in accord with competitive plans submitted by various architects. R. Clipston Sturgis, 120 Boylston St., Boston, Mass., is acting as professional adviser in award of plans. Working drawings will be prepared and bids called for in about 90 days. The building will contain 16 class rooms, auditorium and gymnasium. Cost; about $150,-000.

NEW YORK, N. Y.—We are officially advised that the J. E. Olson Construction Co., 39 West 25th St., is taking estimates for a 9-story building to be constructed of steel, brick and stone at 37 East 28th St. The structure will be 41.8 × 98.9 ft. and will cost $185,000. Frederick C. Zobel, 114 East 28th St., is Arch.

A 6-story apartment house will be built by the Silversoa-London Construction Co. on 113th St., west of Amsterdam Ave. It will be 75 ft. front and 87.4 ft. deep, with a facade of brick with trimmings of limestone. It will contain 24 suites of apartments, and will cost $100,000. George F. Pelham is Arch., 503 Fifth Ave.

Plans have been filed for a 12-story fireproof apartment house to be built for the Allonel Construction Co., Emanuel Hellner, Pres., at the corner of Broadway and 100th St. It is to have a Broadway frontage of 46.9 ft. and a depth in the street of 170½ ft. and will be finished with ornamental façades of brick with trimmings of limestone and terra cotta in the style of the Italian Renaissance. The interior is planned for two suites of apartments on the first floor and for four suites on each of the other stories. The building is to cost $500,000. William L. Rouse, 11 East 43d St., is Arch.

Bids are asked until 2 p. m., Sept. 17, by John F. Ahearn, Pres. Boro. of Manhattan, for repairs and alterations to, and the material and labor required for alterations in rooms on sixth and seventh floors; also for extension to the electric lighting equipment; for carpentry and cabinet work, hardware, metallic and other furniture, painting, electric lighting fixtures, marble and bronze work, plastering, fireproofing and other work in the Hall of Records Building, New York.

NEW YORK, N. Y.—William A. Rouse, Arch., 11 East 43d St., has filed plans for 16-story office building to be built for the Century Holding Co., J. T. Lee, Pres. The building will cover a plot 50.10 × 93 ft., at 1182 Broadway, adjoining the site of the Hotel Breslin. The style will be renaissance, in brick, with limestone and terra cotta ornamentation. The entrance will be adorned with large doric columns. Around the top stories doric pilasters will support the cornice. The construction will cost $500,000.

On the site of the old Everett House, Union Sq., there is to be constructed a 17-story business building. The building will be in general of the doric type. The base of the structure will be of polished and carved granite, and the lower stories of Indiana limestone. Above the lower stories the façades will be of ornamental dull glazed terra cotta, the prevailing color being white. In the main entrance hall will be two doric columns of Levanto marble, surmounted by a portico. The building is to be of extra heavy skeleton steel construction, and is to have ten elevators, five passenger and five freight. The building will have an actual street frontage of 127.7 ft. on Union Sq. facing south, as well as a street frontage on Fourth Ave. of 142 ft. The south side of the building overlooking Union Sq. probably will be used for offices. Each floor will contain over 14,000 sq. ft. and all floors will have ceilings of exceptional height. The general contract has been awarded to the GEORGE A. FULLER CO., Flatiron Bldg., New York. The owner is the Everett Investing Co., of which the officers are W. H. Chesebrough, Pres.; E. Clifford Potter, Vice-Pres., and Clarke G. Dailey, Secy. and Treas. Goldwin, Starrett & Van Vleck are Archs. Noted on Aug. 20.

NEW YORK, N. Y.—Bids are asked until 11 a. m., Sept. 21, by C. B. J. Snyder, Supt. School Bldgs., Dept. of Education, for moving temporary buildings from rear of Public School 84, Glenmore and Stone Aves., and Watkins St. to the corner of Church Ave. and East 48th St., and also for alterations, repairs, etc., at Eastern District High School, Marcy Ave., Rodney and Keap Sts., Boro. of Brooklyn; for the installation of a water supply system for the buildings of the Parental School on the westerly side of road between Flushing and Jamaica, about 1,700 ft. south of North Hempstead Turnpike, Flushing, Boro. of Queens.

NEW YORK, N. Y.—We are advised by Hiss & Weekes, Archs., 1123 Broadway, New York, that the Belnard Realty Co. is having plans prepared for an apartment house. The building, which will be completed in about a year, will occupy the entire block bounded by Broadway, Amsterdam Ave., 86th and 87th Sts. It will be 350 ft. long, 200 ft. wide and 150 ft. high. It will be twelve stories in height and will have 175 apartments, each containing from nine to fourteen rooms. It will cost more than $3,000,-000. Its first two stories will be of light gray Indiana limestone. The other ten floors will be of buff brick with terra cotta trimmings. The main entrance, consisting of a double driveway leading into an interior court, will be on 86th St. The courtyard will be 250 × 100 ft. Among those interested are Henry R. Hoyt, 11 William St., and Sherman Hoyt, 15 Whitehall St.

Bids are asked by Lawrence Gresser, Pres. Boro. of Queens, until 11 a. m., Sept. 22, for building an interior public bath in the Boro. of Queens, together with all the work incidental thereto.

BUFFALO, N. Y.—The Jesuit Fathers in charge of Canisius College, Rev. Father Miller, Pres., will erect four college buildings at Main and Jefferson Sts. on a tract of ten acres of land and Lansing & Beieri, Archs., 371 Pearl St., Buffalo, have been retained to prepare plans for same. The buildings will consist of a main college building 115 × 210 ft., three stories and basement in height; a science building, 56 × 105 ft., two stories and basement; a gymnasium, 56 × 105 ft., two stories and basement, and a chapel, 58 × 144 ft., having main floor, gallery and basement. Bids for these buildings will be asked for in about 60 days, as soon as working drawings are completed. Later dormitory buildings and a central heat, light and power building will be erected.

The Greiner estate, E. H. Greiner, executor, 548 Ellicott Sq., has let contract to J. H. TILDEN & CO., 14 Henry St., to erect a 4-story brick and stone business block, 50 × 200 ft., on Main St., near Chippewa St., and to extend through to Washington St. Cost, $50,000. Bethune, Bethune & Fuchs, 215 Franklin St., are Archs.

*ALBANY, N. Y.—Bids are asked by the State Commission in Lunacy, Capitol, Albany, until 3 p. m., Sept. 23, for conduit for acute hospital, construction, including steampiping, for the Hudson River State Hospital, Poughkeepsie, N. Y., and for the Binghamton State Hospital, Binghamton, N. Y. T. E. McGarr is Secy.; Franklin B. Ware, Albany, is State Arch.

We are officially advised that the WATERPROOFING CO., 147 East 35th St., New York, has secured the contract and is about to begin work on the waterproofing of the New York State Education building at Albany. This building will be erected by the R. T. FORD CO. of Rochester, N. Y., and the architects are Palmer & Hornbostel, 62 William St., New York.

PATERSON, N. J.—William T. Fanning, Arch., Colt Bldg., Paterson, has about completed plans for Public School No. 24 for the Board of Education. $140,000. He is receiving estimates for Public School No. 23. Cost; $100,000.

PHILLIPSBURG, N. J.—The bids received on Aug. 27 for erecting an annex to the high school were as follows: General construction—J. S. Rogers Co., $46,810; H. R. Deal, $49,647; G. W. Beard Co., $45,909; Adam Rade, $52,373; J. W. Emery, $49,030; Phillipsburg Supply & Construction Co., $41,037. Heating—C. W. Richardson, Bridgeton, $6,488; the American Heating & Ventilating Co., $7,800.

TRENTON, N. J.—J. G. DOAK & CO., 2185 East Norris St., Philadelphia, have secured the contract for building the City Hall in Trenton. The prices at which the firm has agreed to erect the building is $450,000. Work will be begun at once. The building will probably be completed late next fall. The Trenton City Hall will be a 4-story structure of marble, about 80 × 300 ft., with accommodations for all of the law courts, city offices, etc. The plans for the building were drawn by Spencer Roberts, Wightman Bldg., Philadelphia. Noted on Aug. 27.

HARRISBURG, PA.—George A. Glenn & Co., 930 North Eighth St., Philadelphia, Pa., have submitted the lowest estimates on every alternate required by the Commission for the erection of the State Hospital for the Criminal Insane at Farview. Sax & Abbott, 1328 Chesnut St., Philadelphia, were the second lowest bidders. The following are Glenn & Co.'s estimates: For naug stone, $121,480; for Pennsylvania marble, $119,830; for hummelstone, $119,680; for Indiana limestone, $116,980.

PHILADELPHIA, PA.—Stacey, Reeves & Sons, 1611 Filbert St., have secured a permit and will start work at once on the erection of the dormitory building to be erected for the University of Pennsylvania at the corner of 36th and Spruce Sts. The building will be four stories high, of brick and stone and will cover an area measuring 104 × 54 ft. It will be erected at a cost of $65,000 and will complete the quadrangle there. Cope & Stewardson, 320 Walnut St., are Archs. Noted on Aug. 20.

VILLANOVA, PA.—E. F. Durang, Arch., 1200 Chestnut St., Philadelphia, has plans ready for bids for a 3-story engineering building for the Villanova College, Villanova. Estimated cost, $175,000.

PITTSBURG, PA.—W. B. BENNETT, 742 North Negley Ave., Pittsburg, has secured contract to erect a 7-story warehouse for J. W. Huston Co., at about $50,000. O. M. Topp, Westinghouse Bldg., Pittsburg, is Arch.

WILKINBURG (Pittsburg post-office), PA.—Bids are asked until Nov. 1 for constructing a 3-story brick and stone fireproof high school for the Wilkinburg School District, J. M. Lindsay, Secy. The building will be three stories high, 132 × 264 ft. and will

cost $200,000; equipment, $60,000. Thomas H. Scott, MacChesney Bldg., Pittsburg, is Arch.

BLAIRSVILLE, PA.—Blairsville Seminary is to be rebuilt. The present grounds have been sold and a 30-acre site a short distance outside of Blairsville, Pa., has been selected upon which a group of buildings are to be constructed. The first building is to be started this fall. The plans have been completed and contracts will be awarded soon. The first building will be the main one in the group. It is of Victorian gothic architecture and will cost $125,000. Simpson & Smeltz are Archs.

MILLVILLE, PA.—The Board of Education has decided to employ an architect to prepare plans for a school building, to contain 17 rooms and to cost $55,000.

PITTSBURG, PA.—We are officially advised that the FOUNDATION CO., 115 Broadway, New York, has secured the contract and is commencing work on the construction of the caisson piers for the foundations of the Oliver Building in Pittsburg. This building is being erected for the executors of the estate of H. W. Oliver, and is located at the junction of Sixth Ave., Smithfield and Oliver Sts. The general contractor is JAMES L. STUART, 341 Sixth Ave., Pittsburg, and D. H. Burnham & Co., Railway Exchange, Chicago, Ill., are Archs.

MERCER, PA.—Bids are asked until Sept. 21 by Owsley & Boucherle, Archs., Wick Bank Bldg., Youngstown, Ohio, for the erection of a court-house to be erected here at a cost of $300,000. The building will be 92 × 180 ft., three stories in height, and constructed entirely of stone. It will contain a central steam heating plant and electric light plant.

*WASHINGTON, D. C.—Bids are asked until 3 p. m., Oct. 6, by James Knox Taylor, Supervy. Arch., Washington, for a new vault in the office of the Comptroller of the Currency of the U. S. Treasury Department, Washington, D. C.

WASHINGTON, D. C.—The Commissioners of the District of Columbia have awarded contract to PAVARINI & WYNE, Munsey Bldg., Washington, for the construction of a district workhouse at a cost of $78,441. The original bid of $111,000 of this company was in excess of the appropriation of $85,000, but by omitting light and heat and otherwise changing the specifications, the price was reduced.

The Superintendent of the Library of Congress, Washington, has awarded contract to SNEAD & CO., foot of Pine St., Jersey City, N. J., for the construction of a roofed book stack in the southeast court of the Library building, for the sum of $219,990. The stack includes 15,120 shelves for books and 10,000 shelves for newspapers. The bidder agrees to erect additional book shelves at 72 cts. each and additional newspaper shelves at 90 cts. each.

Bids are asked by the Chief of the U. S. Weather Bureau, Dept. of Agriculture, Washington, D. C., until noon, Sept. 22, for the completion of an unfinished 3-story and cellar stone building and the completion of the interior heating system of a 2-story and cellar frame building for the Weather Bureau, Dept. of Agriculture, at Mt. Weather, Va. James Wilson is Secy. Dept. Agriculture.

ATLANTA, GA.—An apartment house, 190 × 137.5 ft., is to be erected at the corner of Ponce de Leon Ave. and Boulevard, containing 50 apartments and to cost, when completed, between $150,000 and $200,000. The plans, drawn by Walter & Edwards, Archs., have been accepted, and the Ponce de Leon Apartment Hotel Co., owners, propose to begin the actual work of construction on or about Oct. 1.

BIRMINGHAM, ALA.—We are officially advised that Warren & Welton, Archs., Title Guarantee Bldg., Birmingham, will have plans for the proposed Chamber of Commerce Building ready for bidders about Sept. 15. It will be a 7-story fireproof structure, 100 × 100 ft., and 100 ft. high, of reinforced-concrete construction, with terra-cotta cornice to two lower stories and light brick facing. Cost, $120,000.

SHREVEPORT, LA.—JOHN ARTHUR has been awarded the contract to build the Machinery Hall for the State Fair Association, by the Buildings and Grounds Committee and the Executive Committee. Construction work will begin at once and the hall is to be finished in 90 days.

NEW ORLEANS, LA.—Bids are asked by Col. E. H. Ruffner, Corps Engrs., U. S. A., New Orleans, until 11 a. m., Sept. 30, for furnishing plant, labor, and material and constructing reinforced-concrete buildings at Burrwood, Southwest Pass, Mississippi River.

It is stated that the Audubon Hotel Co. contemplates receiving bids about Oct. 15 for erection of an office building to be constructed in place of $1,500,000 hotel previously noted. The building will contain stores, arcade and offices. It will be twelve stories high, 160 × 160 ft., fireproof construction, with overhead system steam heating, electric lighting, traction type electric elevator, vacuum cleaning system, house and fire pumps, ventilating fans. Cost $800,000. Plans are being prepared by Kennedy, Werner & Adkins, 72 Mitchell Bldg., Cincinnati, Ohio.

LOUISVILLE, KY.—Plans are being prepared by McDonald & Dodd, Archs., Equitable Life Bldg., Louisville, for the erection of a 7 or 8-story apartment house to be built on the east side of Fourth St., two doors north of Oak, to cost between $150,000 and $200,000. The ground fronts 90 ft. on Fourth St. and runs back 210 ft. to an alley.

COLUMBUS BARRACKS (Columbus postoffice), OHIO.—Bids are asked by Capt. H. J. Hirsch, Constr. Q. M., until 10 a. m., Sept. 15, for construction of one double set Hospital Corps sergeants' quarters at this post, including plumbing, electric light wiring and fixtures.

COLUMBUS, OHIO.—Howard, Inscho & Merriam, Archs., have let general contract to the CINCINNATI CONCRETE STEEL CO., Cincinnati, for a 6-story warehouse and office building for Throop-Martin Co., Columbus. Cost, $50,000.

BEDFORD, IND.—James Knox Taylor, Supervy. Arch., Treasury Dept., Washington, D. C., has awarded contract for the construction of a post-office building at Bedford, Ind., to the BEDFORD STONE & CONSTRUCTION CO., Traction Terminal Bldg., Indianapolis, Ind., at $46,610. Time, Oct. 1, 1909.

MICHIGAN CITY, IND.—J. W. Studebaker, of South Bend, Ind., will receive bids for the construction of an 8-story brick and stone office building to be erected in this city. Estimated cost, $300,000.

ANN ARBOR, MICH.—Bids are asked until noon, Sept. 22, by the Board of Regents of the University of Michigan at Ann Arbor, for erecting an addition to the Engineering Building. Albert Kahn is Arch., 58 Lafayette Boulevard, Detroit. As noted in Engineering News on July 23, bids will be received at the same time and place for erecting a chemical laboratory building. Smith, Hinch & Grylls, Archs. and Engrs., 710 Washington Arcade, Detroit. Shirley W. Smith is Secy.

KALAMAZOO, MICH.—The State Board of Education, Lansing, Mich., let general contract to GEORGE RICKMAN SONS CO., Kalamazoo, at $57,500, for the construction of a training school building at the Western State Normal School, Kalamazoo. Luther L. Wright is Secy.; E. W. Arnold, Arch., 278 Garfield Ave., Battle Creek, Mich.

SPRINGFIELD, ILL.—Barnett, Haynes & Barnett, Archs., Frisco Bldg., St. Louis, are preparing plans for a 7-story hotel for the Leland Hotel, Louis Wiggins, Mgr., Springfield. Cost, $150,000.

CHICAGO, ILL.—A school building, 14 stories high, is to be erected by the Board of Education, Otto C. Schneider, Pres., and instructions have been given to Dwight H. Perkins, Arch. for Board, to prepare the plans. The school will be erected at Plymouth Court and Harrison St. and it is estimated that the cost will be $1,000,000. All the offices of the Board of Education will be located in this building.

The Bismarck Garden is to be enlarged by the construction of a music hall at the corner of Grace and North Halsted Sts. The building will be put up by Emil and Karl Eitel, proprietors of the Bismarck Garden, and will cost $100,000. Huehl & Schmidt are Archs., Metropolitan Block, Chicago.

James Knox Taylor, Supervy. Arch., Treasury Dept., Washington, D. C., has awarded contract for painting and decorating the Chicago post-office at $45,000 to W. P. NELSON CO., 241 Michigan Ave., Chicago.

EVANSTON, ILL.—George W. Maher, Arch., 218 La Salle St., Chicago, is completing plans for a fireproof 2-story gymnasium, 192 × 228 ft., with a training shed, 214 × 128 ft., to be erected at Sheridan Road and Haven St., Evanston, in connection with the Northwestern University. It will cost, including a swimming pool, $150,000. Work is to be begun soon.

MOUNT VERNON, IOWA.—W. J. ZITTERAL, of Webster City, Iowa, has secured contract to build a gymnasium, to cost $50,000, for Cornell College, Mount Vernon.

INDEPENDENCE, IOWA.—The State Board of Control at Des Moines has awarded the contract to erect two hospitals, one at Independence and the other at Cherokee, to LOUIS J. LAURITZEN, of Waterloo, at $90,000 and $90,400, respectively.

EVELETH, MINN.—The Board of Education is reported to have received bids on Aug. 29 as follows for erecting a high school: Duplaise Co., Superior, Wis., $65,690; F. C. Norlander, St. Paul, $64,987; McLeod & Smith, Duluth, $64,900; J. A. Roberts, Duluth, $62,800; and for structural iron work, Twin City Iron & Wire Works, $8,426; American Bridge Co., of Minneapolis, $8,426.

WICHITA, KAN.—The contract for the building to be erected at 125 and 127 North Main St., and which is to be known as the Black Building, has been let to FRANK BORDEN, of this city, and work on the structure is to be begun at once. The building, which is to cost $43,000, is to be three stories high, with basement. The material used will be buff brick and Carthage stone. The building is to extend to the alley, and when completed is to be occupied by the Walker Dry Goods Co.

GRAND ISLAND, NEB.—James Knox Taylor, Supervy. Arch., Treasury Dept., Washington, D. C., has awarded contract for the construction of a post-office building at Grand Island, Neb., to D. E. MARSHALL & CO., 2011 East Tenth St., Kansas City, Mo., at $105,000. Time, March 31, 1910.

ST. LOUIS, MO.—We are officially advised that the JOHN PEIRCE CO., 90 West St., New York, has secured contract at $1,379,000 for erecting Central Library at St. Louis, Mo., plans by Cass Gilbert, 11 East 24th St., New York. A monumental building of granite will be erected with steam heat, electric lighting, electric elevators. Contracts for bookstacks, to cost probably $40,000, have not been awarded. Estimated cost of building complete, $1,650,000.

Bids for the erection of the Sumner Colored High School were received on Sept. 1 by the Building Committee of the Board of Education. The lowest bidder was the Nicholas Pelligreen Construction & Investment Co., 816 Pine St., which offered to build the structure for $297,827. The other bidders were: Charles Q. A. Brunk, $298,000; Hoosac Building & Construction Co., $299,970; Hartmann Building & Contracting Co., $310,275; Wall Bros., $314,090; E. C. Gerhard Building Co., $314,697; Hill-O'Meara Construction Co., $316,500; Gillick Bros., $318,880; Kellerman Contracting Co., $324,700; S. L. Jones Building Co., $326,500; Hiram Lloyd Building & Construction Co., $327,557; Fred Boeke, $334,000; J. W. Wilson & Son, $339,000. The structure is to be built on Cottage, between Goode and Pendleton Aves. The structure is to be 418 ft. on Cottage Ave. by 104 ft. deep. The building is designed to accommodate 500 pupils and is to contain 57 rooms, including an auditorium, a library and a gymnasium. It will contain a small conservatory, woodworking shops, printing office, machine shop and forge room. W. B. Ittner is Arch. Bd. of Education.

PORT ARTHUR, TEX.—The bids received on Aug. 22 at the office of Jan Van Tyen, Pres. Port Arthur Hotel Co., for erecting a 3-story concrete and brick hotel have been rejected and new bids will be received. Probable cost, $150,000. C. A. Logan, P. O. Box 617, is Arch.

TULIA, TEX.—Plans will be received until Sept. 20 for the erection of a court-house, to cost about $60,000. T. A. Ross is County Clerk.

HOUSTON, TEX.—We are officially advised that the H. L. STEVENS CO., Knoxville, Tenn., has been awarded contract for the Bristol Hotel annex, Houston. The building will have seven stories and basement and will be built of reinforced concrete throughout. Approximate cost, $150,000.

DENVER, COLO.—A 3-story and basement apartment house, to contain 45 apartments, will be built at Eleventh and Sherman Aves. by J. J. Hall. MATHERS & WALKER have the contract for construction. Cost, $135,000.

SPOKANE, WASH.—Thomas Hagan has bought a site at the corner of Second and Hilliard Sts., and he will erect a 3-story building, 50 × 142 ft., at a cost of about $40,000. The building will cover the entire ground. It will have six stores on the first floor and two upper floors will be finished in suites for living apartments. There will be a full basement under the building. It will be heated with hot water or steam. Work will begin on the excavation soon.

SAN FRANCISCO, CAL.—Plans for the proposed San Francisco National Bank Building, to be erected at the corner of California and Leidesdorff Sts., have been completed by D. H. Burnham & Co., Railway Exchange, Chicago, Ill., and construction will begin as soon as the Bank of California vacates the old building. The architects announce they expect to have the building finished and ready for occupancy by the middle of March or April 1 next. The new structure will be of steel-frame construction throughout, all its steel being protected from fire and corrosion with concrete. It will be four stories in height, with a high basement. The banking offices will be on the ground floor, which, with the basement, will be finished in marble and bronze. The upper floors will be arranged for offices, with marble corridors.

Plans and specifications have been completed for a 7-story steel-frame structure to be erected on the corner of Kearny and California Sts. The building is to contain four stores on the ground floor and 75 large rooms on the upper floors. The building will have a front of pressed brick and terra cotta, and will be equipped with all modern appliances—hot and cold water in every apartment, steam heating, gas and electric lighting and fast passenger elevators. It will have a frontage on Kearney St. of 65 ft. 3 ins., and 39 ft. 2 ins. on California St. The building will cost $75,000, and is to be completed in eight months. L. B. and J. Feigenbaum are the owners, and Salfield & Kohlberg, 1105 Golden Gate Ave., are Archs.

Bids are asked by Col. F. L. Denny, Q. M., Washington, D. C., until 11 a. m., Sept. 15, for the construction and completion of a marine barracks and officers' quarters at the Naval Training Station, San Francisco. Plans, etc., may be seen at the office of Reid Bros., Claus Spreckles Bldg., San Francisco, and at the office of the Depot Quartermaster, U. S. Marine Corps, 330 Jackson St., San Francisco.

ONTARIO, CAL.—The plans of John C. Austin, Pacific Electric Bldg., Los Angeles, for the proposed high school building at Ontario have been accepted and approved by the Board of Supervisors, and construction will be begun within a few weeks. The school will cost $50,000, and will be of brick and as nearly fireproof as possible with this material. The architecture of the building is mission in character. The exterior will be of hard plaster over the brick work, with terra cotta and stone trimming at door and window openings. Part of the building will be two stories. A basement will be excavated under the entire structure. The building will occupy the old Chaffey College site.

YARMOUTH, N. S.—Plans have been prepared by G. H. Jost, Arch., 28 Sackville St., Halifax, N. S., for an addition to be built to St. Ambrose Roman Catholic Church at Yarmouth. Thomas W. Carten, Yarmouth, is interested.

MONTREAL, QUE.—J. BORQUE, of Hull, Que., has been awarded the contract for constructing the proposed Commercial High School. Cost, $390,000.

VANCOUVER, B. C.—R. H. Sperling, Gen. Mgr., announces that the directors of the British Columbia Electric Ry. Co. have passed appropriations for this province for the year beginning in September, amounting to $4,280,000, and that the construction of an office building and freight shed in Vancouver will be commenced immediately. Freight sheds will be erected at foot of Carroll St., on False Creek. The cost of the new office building will be $200,000.

MOOSE JAW, SASK.—The bid of NAVIN BROS., of Moose Jaw, for the construction of the Collegiate Institute has been accepted, the figure being $93,713. There were six bids submitted for the construction of the building as follows: Navin Bros., $93,713; W. H. Ellis & Sons, Moose Jaw, $97,335; Smith Bros. & Wilson, Regina, $102,000; S. A. Covert, Moose Jaw, $107,850; Davidson Bros., Winnipeg, $108,000; Thos. Kelly, Winnipeg, $108,693; Carter Hall Co., Winnipeg, $108,875. Smith Bros. & Wilson submitted an alternative bid allowing $6,000 reduction from $102,000 if Bedford stone were substituted for Tyndal stone preferred.

WATER SUPPLY—IRRIGATION.

(* *denotes that this work is described in Engineering News.*)

*LIVERMORE FALLS, ME.—Bids were received by Metcalf & Eddy, Engrs., 14 Beacon St., Boston, Sept. 1 for laying c.-i. pipe and appurtenances and building a reservoir. Livermore Falls, for the Water Dist. Bids were as follows: (A) total including station; (B) total, without pumping station: R. D. SHANAHAN, 10 St., Portland, Me. (awarded contract); $12,619; (B) $11,819. Eveline Exchange, boro, Mass. (A), $13,982; (B) $1... Attleboro, Mass. & Co., Kennebunk, Me., Ward A. De Marco, 176 Endicott St., $15,918. $15,439; (B) $14,489. Narco, Inc., (A) Co., Canton, Me., (A) $15,856; $15,196. Small & Ingalls, Bar Harbor, (A) $16,958; (B) $15,808. Michael enough, Swampscott, Mass., (A) $18,283; $17,- 233; C. E. Trumbull Co., Tre... Bldg., Boston, (A) $18,538; (B) $17,098. Gregor Bros., Rumford Falls, Me., (A) James H. Kerr, Rumford Falls, 799; (B) $18,655. Chas. N. Tilesby, Mass., (A) $20,047; (B) $19,- Wel- Lowest bidder for furnishing the Renssalaer Mfg. Co., Troy, was $360. Y., at

*BOSTON, MASS.—Bids were received as follows on Sept. 2, by the Metropolitan Water and Sewerage Board, for lay... 12,400 lin. ft. of c.-i. water pipe in Boston and Brookline, Mass. Henry H. Sprague, Chr., Dexter Bracket is Ch. Engr. Water Wks. Ashburton Pl., Boston: Frank Williams, Boston, $32,791; BRUNO & PETITTI, Boston, $36,157 (awarded contract); Bryne Contracting Co., Boston, $37,687; Coleman Bros., Boston, $38,500; Kennelly & Gaddis, Boston, $40,100; C. E. Trumbull Co., Boston, $40,444; Falvey & Kelly, Somerville, Mass., $42,425; John A. Costello & Co., Roxbury, Mass., $43,716; Boston & New York Contracting Co., Boston, $48,321; James Driscoll & Son, Brookline, Mass., $48,845; Hugh Nawn Contracting Co., Roxbury, $57,015. Itemized prices are given in this issue under Contract Prices.

GARDNER, MASS.—Bids were received on Sept. 1 by Charles E. Thompson, Supt. State Colony for the Insane, Gardner, for furnishing about 308 tons of 6-in. c.-i. water pipe; and specials. H. K. Barrow, 6 Beacon St., Boston, Mass., is Engr. Contract was awarded to CHAS. MILLAR & SON CO., Utica, N. Y., at $23.40 per ton for pipe, and $50 per ton for special castings.

WEST SPRINGFIELD, MASS.—Bids were received on Sept. 1 for the construction of a filter at Bear Hole. The contract was awarded to P. A. BREGLIO CONTRACTING CO., of Springfield, at $6,597. F. A. Barbour, Tremont Bldg., Boston, Engr. Noted last week.

SPRINGFIELD, MASS.—Contract No. 1 of the Little River water supply was let on Aug. 26 to FRED. T. LEY & CO., of Springfield. E. E. Lochridge is Ch. Engr., Br. of Water Comrs.

*WALLINGFORD, CONN.—Bids were received on Aug. 31 by the Board of Water Commissioners for laying water mains. The lowest bidders were A. B. Griswold, New Britain, Conn., $4,770; McCoy Engineering Co., Baltimore, Md., $4,968; Henry Spinach Contracting Co., Waterbury, Conn., $6,020.

ALTAMONT, N. Y.—Leslie Allen, 24 De-Graf Bldg., Albany, N. Y., is reported to be preparing plans for addition to reservoir and gravity water system for the village of Altamont. Bids will be called for by the Village Board of Trustees.

BUFFALO, N. Y.—B. I. CROOKER has the contract at $40,148 for the erection of a boiler house at the North pumping station.

CANAJOHARIE, N. Y.—At the special election, held Aug. 29, it was voted to expend $75,000 for the construction of a municipal water works plant. Plans will be completed and bids soon called for by the Board of Village Trustees. A conduit, to cost $2,800, will be built.

*COHOES, N. Y.—The Board of Water Commissioners of Cohoes has decided upon Nov. 2 as the final date for filing plans and specifications, with approximate estimate of the cost, of a mechanical filter plant for this city. H. L. Shaver, Pres.

ROME, N. Y.—Knight & Hopkins, 101 West Dominick St., Rome, Engrs., are preparing plans and specifications for about six miles of 30-in. cast-iron pipe, extending from Stokes, N. Y., to Rome, N. Y. Pipe to be laid at depths ranging from 5 to 10 ft. Bids will be called for by the Board of Water and Sewer Commissioners, Rome, in about three months.

NEW YORK, N. Y.—Bids will be received until 3 p. m., Sept. 17, by the Dept. of Parks, Henry Smith, Pres., for furnishing all the materials and labor for laying water pipe in Bronx, Claremont, Crotona, St. Marys and Van Cortlandt Parks, Boro of the Bronx.

NEW YORK, N. Y.—Bids are asked until 2 p. m., Sept. 16, by the Department of Water Supply, Gas and Electricity, for dismantling and removing the two batteries of two horizontal return tubular boilers each, and their appurtenances, from the boiler room of the 98th St. pumping station, and dismantling and removing two Stirling water tube boilers and their appurtenances now located in the incineration plant at the Delancey St. end of the Williamsburg Bridge, and re-erecting these two Stirling boilers together with their foundations, settings, steam and auxiliary piping and all other appurtenances complete in the boiler room of the 98th St. pumping station, Boro of Manhattan.

Bids are asked at the same time for hauling and laying water mains in Briggs and Burnside Aves., Boro of the Bronx.

Bids are asked until 2 p. m., Sept. 23, for furnishing and delivering double-nozzle hydrants. Also for furnishing and erecting two new brick chimneys at the Millburn pumping station, Baldwin, L. I.

MARCELLUS, N. Y.—F. W. Knapp, City Clk., states that Farrington & Bowman, of Marcellus, are preparing plans for water-works, to cost about $20,000.

PEEKSKILL, N. Y.—Bids were received on Aug. 25 by the Board of Water Commissioners for construction of water filters, pure water reservoir and appurtenances. Contract has been awarded to HARVEY B. SPROUL, of Binghamton, N. Y., for $52,400. The EDDY VALVE CO., of Waterford, secured the contract for the valves, at about $1,236. L. Reynolds, City Engr.; Hazen & Whipple, Consulting Engrs., 103 Park Ave., New York. Noted on Aug. 6.

WOLCOTT, N. Y.—We are officially advised that a preliminary survey and estimate of cost of a water system for Wolcott are in course of preparation. The system will be built by private capital. A normal daily supply of 250,000 gals. and an emergency supply of 1,500,000 gals. will be furnished. H. . Moreland, Wolcott, N. Y., is Engr.

ROCHESTER, N. Y.—Three contracts were awarded on Sept. 3 at a special meeting of the Board of Contract and Supply. DWYER & BARNARD were awarded contract for laying 36-in. hemlock water main in Culver Road, from University Ave. to Atlantic Ave., at $7,020. Schaefer St. gravel pavement contract was let to HOLDER & BAUMAN for $4,460. WHITMORE, RAUBER & VICINUS, contract to construct a trap-rock pavement in Charlotte St., at $8,479.

*NEW YORK, N. Y.—Bids were received by the Board of Water Supply on Sept. 1 for the construction of a 3-mile stretch of plain concrete conduit known as cut-and-cover aqueduct, 17 ft. high × 17½ ft. wide inside, approximately between Ireland Corners and New Hurley in the towns of Gardiner, Plattkill and Shawangunk, Ulster County, New York. J. Waldo Smith is Ch. Engr. Bd. List of bidders and itemized prices are given in this issue under Contract Prices.

TRENTON, N. J.—The contract for the construction and installation of a 20,000,000-gal. pumping engine has been awarded to the CAMDEN IRON WORKS, of Philadelphia, Pa., at $84,500. Bids were received on Aug. 12; noted fully on Aug. 27. Chas. A. Hague, New York, is Engr.

FRANKLIN, PA.—Bids are asked until 1 p. m., Sept. 11, by the County Commissioners, E. K. Smiley, Clerk, for constructing reinforced concrete reservoir.

PHILADELPHIA, PA.—Bids were received as follows on Sept. 3 by the Department of Public Works, for Contract No. 152; Apparatus for cleaning slow sand filters for the Upper and Lower Roxborough and Torresdale filters: George P. Baldwin, $5,500; E. M. Nichols, $11,500; Link Belt Engineering Co., $22,950.

PENNSBORO, W. VA.—Bids will be received until Sept. 12 by W. J. Nutter, Recdr., Pennsboro, for furnishing material and construction pipe distributing system and water storage tanks for the proposed water-works.

NORTH WILKESBORO, N. C.—J. B. McCrary & Co., of Atlanta, Ga., are making surveys for the construction of water-works.

BIRMINGHAM, ALA.—See under Light and Power Plants.

*GULFPORT, MISS.—Bids are asked by the Mayor and Board of Alderman until 8 p. m., Sept. 15, not Sept. 5 (as noted last week) for the construction of a reinforced concrete reservoir.

BELLEVUE, KY.—The City Council on Aug. 27 granted a water franchise to Jas. C. Ernst and associates.

CINCINNATI, OHIO.—Bids are asked until noon, Sept. 25, by the Board of Trustees, Comrs. of Water-Works, for the construction and delivery of machine tools and other appurtenances at the several pumping stations and filtration plant and at the intake pier of the water-works.

SUTTONS BAY, MICH.—Bids will be received until Sept. 10 by Archie W. Gunn, Village Clk., for furnishing material and constructing a system of water-works. Marcus Hoyt, Chn. Water-Wks. Com.

NEW BOSTON, ILL.—New bids are asked (under amended specifications) until 2 p. m., Sept. 30, by the Commissioners of the Bay Island Drainage and Levee District No. 1, County of Mercer, Ill., at New Boston, for erecting a pumping plant and sluiceways, including three water tube boilers, three engines and three centrifugal pumps. The Harman Engineering Co., 120 Fredonia Ave., Peoria, Ill., is Engr. Advertised in issue of June 18. Bids were received on July 29.

*PITTSFIELD, ILL.—Bids are asked by Williams & Williams, Pittsfield, Ill., until Sept. 17, for furnishing and installing a 57,000-gal. per minute centrifugal pumping plant, to be located on the Illinois River about three miles below Meredosia, Ill.

CUMBERLAND, WIS.—See under Light & Power Plants.

MOUNT HOREB, WIS.—Bids will be received by the Village Board until 7.30 p. m., Sept. 11, for cast-iron pipe, valves, hydrants and laying pipe. W. G. Kirchoffer, Engr., 31 Vroman Bldg., Madison, Wis.

*BURLINGTON, IOWA.—Bids are asked by the Joint Board of Supervisors of Louisa County and Des Moines County, acting for and on behalf of the Louisa-Des Moines Drainage District No. 4, until 2 p. m., Oct. 6, for boilers, steam engines, gas engines and centrifugal pumps. Harman Engineering Co., Peoria, Ill., is the Engr.

KERWATIN, MINN.—P. A. McEachin, Village Recorder, states that bids will be opened about Sept. 22 for the construction of water-works. Noted on Aug. 20.

PILGER, NEB.—F. H. WHEELER, of Havelock, Neb., has secured the contract for constructing water-works, for $9,806. Bids were opened on Aug. 25.

VERNON, TEX.—City will vote on Sept. 10 on issuance of bonds for water-works, sewer system, erection of school buildings and city hall. Amount for water system, $15,000. L. P. Bonner is Mayor.

WINLOCK, WASH.—C. E. Lemard, City Clk., states that H. W. Aller, of Chehalis, is preparing plans for water-works, to cost about $10,000. Noted on Aug. 20.

OAKLAND, CAL.—Bids are asked until 10 a. m., Sept. 23, by the Board Public Works, for the construction of a pumping station for a high pressure fire system, on the western shore of Lake Merritt on the site known as "The Willows."

KAYSVILLE, UTAH.—City has granted franchise for water-works to Heber J. Steiner.

NANAIMO, B. C.—T. H. Tracy, of Vancouver, B. C., has been retained to make surveys for a permanent water supply for this city. Estimated cost, $100,000.

SEWERAGE.

(denotes that this work is advertised in Engineering News.)*

ST. ALBANS, VT.—We are officially advised that the bids received on Aug. 31 by the Mayor and Aldermen for constructing sewers here were: Ablett & Bowes, Cohoes, N. Y., $15,011; Rowe Construction Co., $14,112; OSGOOD CONTRACTING CO., Nashua, N. H., $13,941 (awarded contract). A. W. Dudly, Manchester, N. H., is Engr.

THOMPSONVILLE, CONN.—Bids were received on Aug. 26 by the Sewer Commissioners for the construction of the Enfield St. sewer, and the contract has been awarded to A. B. GRISWOLD, of New Britain, at $4,451.

NEW YORK, N. Y.—Bids are asked until 2 p. m., Sept. 17, by John F. Ahearn, Pres. Boro. of Manhattan, for constructing sewers in various streets in Manhattan and for supplying sand, cement, lumber, manholes, covers, etc.

WATERTOWN, N. Y.—On Aug. 31 at the office of the City Engineer bids were received for proposed improvements by the city in West Mullin, Pine and Maple Sts. There were three bidders: Mulderry Bros., of Albany; C. D. Hodge & Co., of Watertown, and Thomas J. Ward, of Watertown. The prices submitted were as follows: Mulderry Bros., earth excavation, $1.20; rock excavation, $3.25; No. 12 tile, 73 cts.; No. 10 tile, 65 cts.; No. 8 tile, 60 cts. C. D. Hodge & Co., earth excavation, 98 cts.; rock, $3.50; No. 12 tile, 52 cts.; No. 10 tile, 37 cts.; No. 8 tile, 27 cts. T. J. Ward, earth excavation, 65 cts.; rock, $2.95; No. 12 tile, 45 cts.; No. 10 tile, 36 cts.; No. 8 tile, laid, 26 cts.

NEW BRUNSWICK, N. J.—The following bids were received on Aug. 31 by the Common Council for constructing sewers on Remsen Ave., Sandford St. and George's Road. Bids were as follows: Thomas Meehan & Sons, Philadelphia, 10-in. pipe on Remsen Ave., per lin. ft., $1.11; 10-in. pipe on Sandford St., $2.47; 15-in. pipe on George's Road, $2.12; 5-in. Ys for 10-in. pipe, each, 83c.; 5-in. Ys for 15-in. pipe, $1.25; 5-in. pipe for extending and connecting, 13c.; manholes, each, $65; flush tanks, each $85. Abraham Jelin, 391 George St., New Brunswick, 10-in. pipe on Remsen Ave., per lin. ft., $1.54; 10-in. pipe on Sandford St., $4.48; 15-in. pipe on George's Road, $2.49; 5-in. Ys for 10-in. pipe, each, 80 cts.; 5-in. Ys for 15-in. pipe, $1.10; 5-in. Ys for extending, 12 cts.; manholes, each, $65; flush tanks, each, $50. H. V. Oliver Contracting Co., New Brunswick, 10-in. pipe on Remsen Ave., per lin. ft., $1.77; 10-in. pipe on Sandford St., $5; 15-in. pipe on George's Road, $2.75; 5-in. Ys for 10-in. pipe, each, 75 cts.; 5-in. Ys for 15-in. pipe, $1.25; 5-in. extending and connecting, 10 cts.; manholes, $80; flush tanks, $80. McGovern & Hillman, New Brunswick, 10-in. pipe on Remsen Ave., $1.70; 10-in. pipe on Sandford St., $4.75; 15-in. pipe on George's Road, $2.40; 5-in. Ys for 10-in. pipe, 62 cts.; 5-in. Ys for 15-in. pipe, $1.22; 5-in. for connecting and extending, 8 cts.; manholes, $75; flush tanks, $60. James H. Sheehan, New Brunswick, 10-in. pipe on Remsen Ave., $1.45; 10-in. pipe on Sandford St., $2.63; 16-in. pipe on George's Road, $1.90; 5-in. Ys for 10-in. pipe, 54 cts. Frederick Schneider is City Engr.

TRENTON, N. J.—Bids are asked until 8 p. m., Sept. 15, by the Common Council, for the construction of a sewer in Thropp Ave., from a point near the Delaware & Bound Brook R. R., southerly to Stuyvesant Ave., there to connect with Sewer No. 390. The sewer is to be constructed with house connections to the curb lines on each side of the street.

POINT PLEASANT, N. J.—We are officially advised that the following bids were received on Sept. 3 by the Mayor and Borough Council for constructing a system of sewers and drains: FIELD, BARKER & UNDERWOOD, Arcade Bldg., Philadelphia, $19,864; 80 days (awarded contract). Atlantic Construction & Supply Co., Bartlett Bldg., Atlantic City, N. J., $21,207; 90 days. James Mannix, 23 Gilchrist St., Jersey City, N. J., $22,531; 120 days. Harrison Construction Co., 837 Broad St., Newark, N. J., $22,691; 75 days. Thos. H. Riddle, 25 Remsen St., New Brunswick, N. J., $23,663. William John Smith, Spring Lake, N. J., $24,863; 60 days. D'Amato & Stepanelli, 74 Summer Ave., Newark, N. J., $31,592; 125 days. Pugh & Hubbard, Witherspoon Bldg., Philadelphia, are Engrs. Itemized prices for this work will be given next week under Contract Prices.

PATERSON, N. J.—John T. Brett, Street Comr., has given notice that it is the intention of the Board of Public Works to construct the following named sewers: In East 23d St., 600 ft.; East 24th St., 600 ft.; East 29th St.; Oak St., 500 ft.; Marshall St., 400 ft.; Paxton St., 500 ft.; Sussex St., 500 ft. All the above sewers will be of 12-in. pipe.

*MOORESTOWN, N. J.—We are officially advised that bids were received by the Township Committee, Township of Chester, Burlington County, at the Town Hall, Moorestown, for furnishing in carload lots and delivering along the line of sewer trench in Moorestown and vicinity about 4,136 ft. of 10-in. best quality salt glazed vitrified stoneware sewer pipe, deep and wide sockets and 172-10-in. × 4-in. "Y" branches; also about 6,894 ft. of 8-in. pipe same quality as 10-in., and 287-8-in. × 4-in. "Y" branches. Charles Laessle is Township Clk., Moorestown, N. J. Earl Thomson, C. E., Township Engr., 301 Market St., Camden, N. J. The contract has been awarded to W. S. FRENCH, Moorestown.

LEBANON, PA.—Bids will be called for at once for constructing about 2,000 ft. of 18-in. pipe sewer in Cumberland and Seventh Sts., Spring and Pheasant Alleys, to the Quittapahilla Creek. John Hunsicker is Chn. of Com. of Citizens, and George W. Hayes, C. E., is the Engr.-in-Charge, both of Lebanon, Pa.

JACKSON, MISS.—The city will construct an extension to sewer system. Estimated cost, $35,000. The city recently issued $196,000 bonds for improving water-works, extending sewer system, streets and sidewalks.

NATCHITOCHES, LA.—Bids will be received until 4 p. m., Sept. 16 by J. B. Aswell, Pres., and Bd. of Administrators, for constructing a sewerage and sewage disposal system at the Louisiana State Normal School at Natchitoches. Ira W. Sylvester is Engr., Alexandria, La.

LOUISVILLE, KY.—On Aug. 21 the Weber Co., of Chicago, made the lowest bid for the work of Section D of the southern outfall sewer construction to the Commission of Sewage, Equitable Bldg.

DAYTON, OHIO.—It is stated that Hecker & Kirchner were low bidders on a $15,000 sanitary sewer to be constructed here. Bids were received on Aug. 23 by the Board of Public Service. The sewer is to be constructed in District No. 5. Thomas M. Pexton is Pres. Bd. Pub. Service.

PIQUA, OHIO.—This city will construct storm sewers in East Piqua this fall, at an estimated cost of $10,000. H. E. Whitlock is City Engr.

UPPER SANDUSKY, OHIO.—Bids are asked until noon, Sept. 15, by A. H. Stutz, Village Clerk, for constructing about 5,275 ft. combined sanitary and storm sewers, 20 to 48 ins. in diameter; 30-in. sewers and under to be of vitrified pipe, others to be of reinforced concrete, brick or vitrified pipe. The Riggs & Sherman Co. are Engrs., Toledo.

JACKSON, OHIO.—Bids are asked by the Village of Jackson until noon Sept. 28, for constructing 1.4 miles of the main sanitary sewer line. Estimated cost, $10,000. J. W. Turner is Engr.; Daniel L. Lewis is Clerk.

FORT WAYNE, IND.—At the meeting of the Board of Public Works held on Aug. 26, the contract for the Forest Park sewer was awarded to DERHEIMER & CO., at $5.44 a lin. ft. The total will be $15,536, which is the estimate of Frank Randall, City Engr.

HANCOCK, MICH.—The contract for the construction of the West Hancock sewer system has been awarded to PHIL O. SHERIDAN, at $6,968, and for sewer pipe to ASTRID S. RASING, of Chicago, Ill., at $744.

ELGIN, ILL.—Bids will be received until Sept. 10 for constructing the Sixth Ward sewer system, to consist of 4,955 ft. concrete sewer and 83,942 ft. of pipe sewer. Cost, $99,054. Carl E. Plum is City Engr.

BURLINGTON, WIS.—N. F. REICHERT, of Racine, Wis., has secured the contract for constructing vitrified pipe sewers, about 18,417 ft. of 20 to 6-in. pipe, 51 manholes and twelve lampholes, at about $12,250. Bids were received on Aug. 26.

PLYMOUTH, WIS.—SCHREITER & CONNOLLY, of Manitowoc, Wis., has secured the contract for constructing a section of sewerage system, bids for which were received on Aug. 25, at $5,451. The work includes 5,151 ft. of 6, 8, 10, 12 and 15-in. vitrified pipe sewers, 16 manholes, two lampholes, river crossing and disposal plant. Other bids received were: H. O. Scafer, Green Bay, $10,241; W. F. Brunt, Hammond, Ind., $8,689; Mulholland & Son, Kaukauna, $7,903; E. A. Barker & Son, Melrose Park, Ill., $5,892; F. E. Kaminski, Berlin, Wis., $5,808; Hackworthy Construction Co., Appleton, Wis., $12,888, and E. R. Harding, Racine, Wis., $10,045. W. G. Kirchoffer, of Madison, Wis., is Engr.; C. W. Jackson is City Clerk.

PESHTIGO, WIS.—Bids are asked by the Board of Public Works until 2 p. m., Sept. 12, for constructing sewers in this city.

SIOUX CITY, IOWA.—Following are the bids received on Aug. 18 for the construction of the Morningside sewer system: (a) $21,000 ft. 8-in. pipe sewers, per ft.; (b) 9,450 ft. 10-in., per ft.; (c) 2,500 ft. 12-in., per ft.; (d) 71 manholes, each: The LYTLE CONSTRUCTION CO., Sioux City (awarded contract), (a) 44½ cts., (b) 54½ cts.; (c) 64½ cts.; (d) $34.75; M. Lewis, Sioux City, (a) 62½ cts., (b) 67 cts., (c) 72 cts., (d) $42; L. Christiansen & Co., Sioux City, (a) 55¼ cts., (b) 63¾ cts., (c) 71¼ cts., (d) $47; J. D. Patten, Sioux City, (a) 69¼ cts., (b) 75 cts., (c) 84½ cts., (d) $47; T. W. Smith, Sioux City, (a) 58 cts., (b) 61 cts., (c) 66 cts., (d) $68.85. G. Y. Skeels is City Engr; T. W. Bayne is Chn. Sewer Com.

CEDAR RAPIDS, IOWA.—Bids are asked until Sept. 20, by L. J. Storey, City Clerk, for constructing pipe sewers in the Eighth Ward. Estimated cost, $1 per foot.

VIRGINIA, MINN.—Bids will be received until 8 p. m., Sept. 15, by the City Council for constructing a sanitary sewer in Sewer District No. 1. Albert E. Bickford is City Clk.

TWO HARBORS, MINN.—Bids are asked until about Sept. 13 by the City Council for constructing a sewer in Third Ave.

HOLDREGE, NEB.—The contract for constructing sewer in District 1 has been awarded by the city Council to LANG & BROWITT, of University Place, at $18,785.

NEWPORT, ARK.—Lund & Hill, Engrs., Little Rock, Ark., recently appointed to design and supervise construction of the proposed sewer system, expect to have plans ready about Sept. 25. The system is to cost from $40,000 to $50,000. Alcorn Ferguson is Chn. Bd. of Improvement, District No. 1.

BELLINGHAM, WASH.—On Aug. 24 the contract for the construction of the Garden St. storm sewer was let to RIDDLE, KAVANAUGH & HAWKINS by the Board of Public Works. The amount of the bid was $9,396. The Bellingham Construction Co., the only other contestant for the work, bid $10,208. The work is to be completed by Feb. 1. H. W. Troutman is City Engr.

SEATTLE, WASH.—The City Council has passed ordinances providing for sewers as follows: West 56th St., cost $4,000; Lane St., $4,800; West 60th St., $12,900; East Boston St., $17,500, and Judkins St., $11,400. R. H. Thomson is City Engr.

SEATTLE, WASH.—Bids will be received about Sept. 19 for constructing the north trunk sewer in Lake Union District. Fixed estimate, $10,000. Following are the approximate quantities: 108-in. sewer, Section B, 4,850 lin. ft.; 108-in. sewer, Section A or D, 8,337 lin. ft.; 108-in. sewer, Section C, 1,530 lin. ft.; manholes, 35; manholes, extra depth, 370 lin. ft.; sandcatcher, 1; Stone way overflow; 30-in. brick sewer, 247 lin. ft.; 24-in. pipe sewer, 330 lin. ft.; 18-in. pipe sewer, 18 lin. ft.; 12-in. pipe sewer, 47 lin. ft.; 8-in. pipe sewer, 47 lin. ft.; manholes, 2; manholes to be reconstructed, 1; Junction manhole, 1; overflow box, 75 lin. ft.; emergency outlet, 1; emergency outlet gates, 1; 6-in. side connections, 200; extra concrete, 1:12, 200 cu. yds.; extra concrete, 1:8, 1,200 cu. yds.; extra steel, 10,000 lbs. R. H. Thomson is City Engr.

REDONDO, CAL.—Bids will be received by Charles J. Creller, City Clerk, until Sept. 14, for the construction of an outfall sewer line, to consist of 3,810 ft. of 10-in. c.-i. pipe and 2,283 ft. 16-in. vitrified pipe. Cost, about $7,000. Olmstead & Gillelen, 616 Grant Bldg., Los Angeles, Cal., are Engrs.

LOS ANGELES, CAL.—The following bids were received by the Board of Public Works on Aug. 17 for the construction of a sewer in San Marino St., from Catalina St. to New Hampshire Ave., and other streets: J. S. McBride, $14,444; N. P. Kovacevich, $15,087; Rogers & Spencer, $16,427; A. H. Calkins & Co., $16,500; M. L. Hostetter, $17,400; C. Ukropina and G. Perovich, $18,000; F. H. Nusbickel, $18,974; A. P. Pusich, $19,950; W. N. Hendricks, $20,800; George Wujacich, $20,995. For construction of sewer in Sunset Boulevard, from Marion Ave. to Douglas St., and other streets: Joe Chutuk, $3,888; R. N. Nikcevich, $4,307; J. S. McBride, $4,349; A. P. Pusich, $4,450; George Wujacich, $4,725; N. P. Kovacevich, $4,882; Rogers & Spencer, $5,287; A. H. Calkins & Co., $6,000; F. H. Nubickel, $6,320; W. N. Hendricks, $7,250.

STREETS AND ROADS.

(denotes that this work is advertised in Engineering News.)*

CONCORD, N. H.—Bids are asked by A. W. Dean, State Engr., Concord, until 5 p. m., Sept. 15, for constructing gravel roads in Stark and Candia to cost $3,400.

Bids are asked at same place until 5 p. m., Sept. 21, for constructing gravel roads in East Kingston and Madbury.

NEW LONDON, CONN.—The WORCESTER CONDUIT & PAVING CO., H. J. McGuire, Treas., has secured contract, at $30,000, for brick pavement in New London.

WATERBURY, CONN.—The Board of Public Works on Aug. 27 awarded the contract for paving East Main St. with Mack block to F. T. LEY & CO., INC., 307 Main St., Springfield, Mass., at $22,169.

JOHNSTOWN, N. Y.—A. D. OSBORN, of Binghamton, N. Y., has secured the contract for paving North Perry St., bids for which were received on Aug. 31, at the following bids: 4,820 ft. straight stone curb, 80 cts.; 567 ft. straight stone headers, 65 cts.; 152 ft. circular curb, $1.50; 80 driveway corners, each, $1.40; 1,194 cu. yds. excavation for railroad, 50 cts.; 570 cu. yds. broken stone for railroad, $2, and 11,164 sq. yds. Pittsburg-Buffalo block, $2.21. Frank Bagaaklie is City Clerk.

NEW YORK, N. Y.—Bids are asked by the Park Board, Henry Smith, Pres., until 3 p. m., Sept. 17, for furnishing and delivering 800 cu. yds. broken stone of trap rock and 400 cu. yds. screenings of trap rock (No. 3, 1908, Botanical Gardens), for parks, Boro. of the Bronx.

Bids are asked at the same time and place for paving and repaving with rock asphalt mastic where directed, the walks of the Central and other parks in the Borough of Manhattan, the City of New York.

Bids are asked by J. W. Stevenson, Comr. of Bridges, until 2 p. m., Sept. 17, for regulating, grading and repaving Second Ave and 59th St., in the Borough of Manhattan, at the entrance to the Blackwell's Island Bridge over the East River, between the Boroughs of Manhattan and Queens.

Bird S. Coler, Pres. Boro. of Brooklyn, has awarded contract to O'GRADY BROS., 72 North Eighth St., Brooklyn, for regulating and repaving with granite on concrete foundation, Kent Ave., from Broadway to North 6th St., at $24,367.

Contract has been awarded by Bird S. Coler, Pres. Boro. of Brooklyn, to ATLANTA CONTRACTING CO., 343 East 91st St., at $20,767, for regulating and repaving with granite pavement on a concrete foundation, Columbia St., from Harrison St. to Hamilton Ave.

NEW YORK, N. Y.—The following bids were received on Sept. 2 by Bird S. Coler, Pres. Boro. of Brooklyn, for regulating and repaving with asphalt on a concrete foundation the roadway of Bond St.: Uvalde Asphalt Paving Co., Broadway, $2,247; Barber Asphalt Paving Co., 30 Church St., $2,229; Cranford Co., 52 Ninth Ave., Brooklyn, $1,916. Regulating, grading, curbing and laying sidewalks on 57th St.: Moran Crowley Co., $4,056; Mangeri Co., $4,657; Pasquali Porzio, 35 Front St., Brooklyn, $4,052; John J. Guynan, $4,175; John J. Riley, $4,104. Regulating and repaving with asphalt pavement on a concrete foundation a portion of the roadway of Lincoln Pl. (DeGraw St.):

Uvalde Asphalt Paving Co., $5,081; Barber Asphalt Paving Co., $5,112; Cranford Co., 52 Ninth St., Brooklyn, $4,583. Regulating and repaving with asphalt paving on a concrete foundation the roadway of Mansfield Pl.: Uvalde Asphalt Paving Co., $1,182; Barber Asphalt Paving Co., $1,224; Cranford Co., 52 Ninth St., Brooklyn, $1,098. Regulating and repaving with granite pavement on a concrete foundation the roadway of Morton St.: O'Grady Bros., $6,622; Thos. Connelly, $6,446; Jas. Quinn, Jr., $7,054; Mathew T. Moore, $6,823; Atlanta Contracting Co., 434 East 91st St., $6,390.

NEW YORK, N. Y.—Bids are asked until 11 a. m., Sept. 22, by Lawrence Gresser, Pres. Boro. of Queens, for regulating, grading, curbing, recurbing and repaving with granite block pavement on a sand foundation the roadway of Myrtle Ave., from the Brooklyn Borough line to (Wyckoff Ave.) McComb Pl., Second Ward, together with all the work incidental thereto.

MINEOLA (L. I.), N. Y.—Cocks & Dalton, of Port Washington, were the lowest bidders for the work of widening and regrading Flower Hill Ave. at Port Washington, at the openings of bids before the Nassau County Board of Supervisors on Aug. 31. Their bid was $16,577, being $367 lower than that of Meserole & Underhill, whose bid of $16,944 was the second lowest. The Russell Contracting Co., New York, bid $17,454. Flower Hill Ave., which it is proposed to widen, is the principal thoroughfare in Port Washington. The time required to complete the contract is 65 working days.

WATERFORD, N. Y.—Bids will be received until 7 p. m., Sept. 14, by the Board of Trustees of the Village, for paving with vitrified brick on Third St., in all about 5,000 sq. yds. of pavement, on 9-in. concrete, 4,200 sq. yds. on 6-in. concrete and 4,300 lin. ft. 6 × 12-in. granite curbing, etc. John Flynn, Jr., is Engr., 83 Third St., Troy.

TRENTON, N. J.—On Sept. 1 the Common Council awarded contract to the UNITED PAVING CO, of Atlantic City, N. J., at $50,817, for paving Princeton Ave. Abram Swan is City Engr.

MONTVALE, N. J.—The contract for macadamizing Grand Ave. has been awarded to E. C. HUMPHREY & CO., of Hackensack, N. J., at $5,711. H. G. Hering, Jr., of Hillsdale, N. J., is Engr.

TRENTON, N. J.—It is stated that the Street Committee of the City Council has recommended for award the contract for bitulithic paving on Princeton Ave. to the United Paving Co., of Atlantic City, at $50,817.

NEWARK, N. J.—Bids are asked until 3.30 p. m., Sept. 17, by the Board of Street and Water Commissioners for furnishing material and repaving a portion of Market St., requiring about 22,500 sq. yds. of wood block pavement on a concrete foundation; 7,000 lin. ft. 6-in. cut granite curb, set in concrete; two catch basins; twelve new catch basins; 700 lin. ft. 16 × 5-in. 4-cut header curb, set in concrete, 25 sets of new 16 × 5-in., 4-cut granite corners, set in concrete; 21 noiseless manhole covers, etc. M. R. Sherred is Ch. Engr.

CAMDEN, N. J.—On Aug. 28 contracts for paving work were awarded as follows: To NEW JERSEY CONTRACTING & CONSTRUCTION CO., **27 Market** St., Camden, for macadam on 26th St., at 95 cts. per sq. yd., and vitrified brick gutters, $2.04 per sq. yd.; to AARON WARD, for granite block on sand on Jefferson Ave., at $1.77 per sq. yd., and for granite block on 4-in. concrete on State St., at $2.41; to FILBERT PAVING & CONSTRUCTION CO., Pennsylvania Bldg., Philadelphia, Pa., for asphalt on Chelton Ave., 2-in. top, 1-in. binder and 6-in. concrete, $1.99, and same contractor for Sycamore, Rose and Eighth Sts., asphalt, 1½-in. top, 1-in. binder and 4-in. concrete, $1.89.

JERSEY CITY, N. J.—On Aug. 31 the following contracts were approved by the Board of Finance for the Street and Water Board: Contract with U. S. WOOD PRESERVING CO., 29 Broadway, New York, for repaving of Communipaw Ave., from Pacific Ave. to Morris Canal Bridge; contract with U. S. WOOD PRESERVING CO., for repaving of Brunswick St., from Montgomery and Wayne St., and Wayne St., from Brunswick St. to a point 200 ft. west; contract with U. S. WOOD PRESERVING CO., for repaving of Twelth St., from Jersey Ave. to Erie St. The Board approved of award of contract to the BARBER ASPHALT PAVING CO., 30 Church St., New York, for the improvement of Bowers St., from Palisade to Ogden Aves., and the contract for the asphalting of Waverly St., from Oakland to Central Aves. The Finance Board also concurred in the award to HENRY BYRNE, 392 Mercer St., Jersey City, of the contract for the repaving of Twelfth St., from Coles St. to Jersey Ave., and from Erie to Henderson Sts. John J. Voorhees is Pres. Bd.

MILFORD, PA.—Bids are asked until Sept. 15 by the State Highway Department, Harrisburg, Pa., for constructing following roads in Pike County: Lehman Township, 7,700 ft.; Green Township, 18,675 ft.

WILKES-BARRE, PA.—Bids are asked until 2 p. m., Sept. 15, by James S. Norris, Controller of Luzerne County, at his office in the city of Wilkes-Barre, to construct curbing and sidewalks along and on the grounds of the Luzerne County court-house according to plans and specifications prepared by McCormick & French, Archs., Laning Bldg., Wilkes-Barre.

WASHINGTON, D. C.—Bids are asked until 11 a. m., Sept. 16, by the Quartermaster, U. S. Marine Corps, Washington, D. C., for constructing concrete walks, brick wall, drains, furnishing iron fence and grading parade ground at the Marine Barracks, Washington, D. C.

*PORTSMOUTH, VA.—Bids are asked by the City Clerk until 8 p. m., Sept. 29, for furnishing and setting 7,800 lin. ft., more or less, of 5-in. granite curbing; and furnishing materials and paving 14,700 sq. yds., more or less, of the following kinds of pavement: Sheet asphalt, vitrified bricks and bituminous macadam or bitulithic, on Lincoln St. between Fourth and Sixth Sts.; on North St. between Court and Crawford Sts., and on Middle St. Bascom Sykes, City Engr.

KEYSTONE, W. VA.—The city has awarded contract to J. D. SHOTT, of Bluefield, W. Va., for construction of sidewalks and sewers. Cost, $12,000. Work is to commence as soon as bonds are placed. George H. Hill, Bluefield, W. Va., is Engr.-in-Charge.

CANTON, N. C.—Bids are asked by J. W. Scott, Town Clerk, until Sept. 20, for macadamizing roads and for constructing sidewalks.

CHATTANOOGA, TENN.—Bids are asked until Sept. 12 by S. B. Cook, Chn. Bd. Park Comrs., for constructing a road through Jackson Park.

SCIO, OHIO.—Bids will be received until noon, Sept. 29, by Harry E. Johnson, Scio, Ohio, for paving streets in this town, covering 18,000 sq. yds. brick paving, with the necessary curbing, drains, etc. Bids for bonds will be received until noon, Sept. 22. J. C. Overmyer, Fremont, Ohio, is Engr.-in-Charge.

YOUNGSTOWN, OHIO.—D. W. Seitz, Asst. State Highway Comr., of Columbus, received bids for macadamizing the Youngstown and Poland road at the County Commissioners' office on Aug. 28. The estimated price set by the State Engineers was $19,761, and all the bids submitted being above this price the contract was not awarded and will be readvertised. Contractors submitted prices and the prices are as follows: G. A. Gialdini & Co., $21,900; Thomas McKee, $24,000; George J. Vetter, $21,324.

Bids will be received until noon, Sept. 16, by the County Commissioners at Youngstown for grading and macadamizing 2.03 miles of road in Poland Township according to the State Law. Estimated cost of the work, $19,981. James C. Wonders, State Highway Comr., Columbus.

CLEVELAND, OHIO.—The following bids were received Aug. 26 by the County Commissioners at Cleveland for improving a portion of Center Road, in Warrensville Township: Cleveland Trinidad Paving Co., 420 Lakeside Ave., N. E., $48,204; Adams Bros. Construction Co., $48,686; Baldwin Bros. & Graham, $48,791; Standard Paving & Construction Co., $51,355; George B. Herring & Son, $52,115; W. B. Townsend Co., $48,802; Russell & Jennison, $53,350; Enterprise Paving & Construction Co., $54,505; Northern Ohio Paving & Construction Co., $55,871.

SPRINGFIELD, OHIO.—Bids are asked until noon, Sept. 15, by the Board of Public Service, Springfield, for improving Grand Ave. and Kenton St., by macadamizing the roadways and constructing combined cement curbing and gutters. William H. Mahoney is Clerk.

LISBON, OHIO.—Bids are asked until noon, Sept. 15, by the Commissioners of Columbiana County for grading and paving with brick 1.20 miles of road in Hanover Township, said county, under the provisions of the State Highway law. James C. Wonders, Columbus, Ohio, is State Highway Comr.

BLUFFTON, IND.—Bids are asked until 7 p. m., Sept. 18, by the Common Council for the improvement of Indiana St., from its intersection with the north line of Eaton Ave. to the corner of lot No. 10 in White's Addition to the city of Bluffton, by the construction of cement sidewalks, four feet wide and one foot from the property line on the east side of said Indiana St. Frank S. Smith is City Clerk.

NEW ALBANY, IND.—Bids are asked until Sept. 12 by the Board of Public Works for furnishing material, grading and paving the roadway of a portion of East Oak and East Tenth Sts. with brick. John C. Short is City Clk.

PERU, IND.—Bids are asked until Sept. 23 by Charles Griswold, County Audr., Peru, for grading, paving and culverts on the following roads: Road Nos. 3, 5, 9 and 10 in Clay Township; No. 1 in Harrison Township; Nos. 1 and 2 in Peru Township.

INDIANAPOLIS, IND.—Bids will be received by the Board of Public Works for the paving of streets as follows: Hawthorne Lane with asphalt; 13th St. with bitulithic; Pine St. with brick and stone curbing; 29th St. with wooden blocks; Northwestern St. with asphalt; Downey Ave. with bitulithic, brick gutter and stone curb.

*GENESEO, ILL.—Bids are asked until 3 p. m., Sept. 16, by the Board of Local Improvements, for improving a part of State St. The approximate amounts of the work are as follows: 14,547 sq. yds of brick pavement; 5,338 cu. yds. of excavation; 6,262 lin. ft. of straight curb (concrete); 170 ft. of 12-in. sewer pipe; ten catch basins. H. L. Kiner is Pres. Bd.; Clark G. Anderson, Moline, Ill., is Engr.

CHICAGO, ILL.—Bids will be received until Sept. 12 by John J. Hanberg, Comr. of Pub. Wks., for furnishing and delivering to the city and the First and 18th Wards yards approximately 1,000 sq. yds. of 2 granite blocks.

Bids are asked until 11 a. m., Sept. 15, by the Board of Local Improvement for constructing cement sidewalks on various streets in this city, covered by 50 items. H. S. Dietrich is Pres. Bd.; Charles A. V. Standish is Secy.

LA CROSSE, WIS.—Bids will be received until Sept. 14 by Board of Public Works, H. J. Beckwith, Chn., for approximately 7,394 sq. yds. macadam pavement, 4,796 ft. cement curb and gutter, and 2,473 cu. yds. grading.

DES MOINES, IOWA.—The BRYANT-FORD-McLAUGHLIN CO. has secured the contract for paving 13th St. with asphalt at $2.09 per yard. Creosoted block paving is projected at Sixth Ave., from Mulberry to Cherry Sts. George D. Dobson is City Engr.

Bids are asked by George F. Poorman, City Clk., until 9 a. m., Sept. 11, for paving on Third St.

DAVENPORT, IOWA.—The DAVENPORT CONSTRUCTION CO. has secured the contract for paving work; the McCARTHY IMPROVEMENT CO., for asphalt on 7th St.

MASON CITY, IOWA.—GEORGE GABLER, of Mason City, has secured the contract for 53,000 sq. yds. creosoted wood block pavement at $2.80 per sq. yd., and 8,900 sq. yds. brick pavement, at $1.90 per sq. yd. Bids were received on Aug. 24. F. P. Wilson is City Engr.

DES MOINES, IOWA.—BRYANT & FORD, of Des Moines, have secured the contract for paving West 30th St. with sheet asphalt; about 6,299 sq. yds., at $2.09 per sq. yd. A. J. Mathis is Mayor.

ST. LOUIS, MO.—Bids are asked until Sept. 22 by the Board of Public Improvement for the improvement of 3½ miles of alleys, to cost about $75,000.

Bids are asked until noon Sept. 15, by the Board of Public Improvements, for paving about 6½ miles of streets. Estimated cost is $315,000, and portions of seven streets will be paved with asphalt, three streets with brick, one street with bitulithic, one street with granite and two streets with telford. W. B. Dryden is Secy.

SAN FRANCISCO, CAL.—Bids are asked until Sept. 11 by the Secretary of the Board of Public Works for paving with asphalt on a cement foundation a portion of Montgomery St. Estimated cost, $46,475.

OGDEN, UTAH.—Bids are asked until 8 p. m., Sept. 21, by the City Recorder, for constructing sidewalks in Sidewalk District No. 18, extension No. 3, being Wall Ave. from 28th to 31st Sts., Lincoln Ave. from 28th to 31st Sts., Grant Ave. from 30th to 31st Sts., 30th St., 31st St. and Patterson Ave. from Wall to Washington Aves., Pingree Ave. from 28th to 30th Sts., and in Sidewalk District No. 21, Extension No. 3, being Van Buren Ave., from 24th to 26th Sts. A. F. Parker is City Engr.

SALT LAKE CITY, UTAH.—Bids are asked by the Board of Public Works, H. G. McMillan, Chn., until 8 p. m., Sept. 11, for grading and curbing in Extension No. 18. There will be 10,000 cu. yds. of grading and 7,000 lin. ft. of curbing. L. C. Kelsey is City Engr.

MANUFACTURING PLANTS.

(denotes that this work is advertised in Engineering News.)*

AUBURN, ME.—Miller & Mayo, Archs., Lewiston, Me., have made plans and specifications for a 4-story shoe factory to be erected immediately in the city of Auburn for the Lunn & Sweet Shoe Co.

SEBEC STATION, ME.—The Sebec Lake Lumber Co. will build at Greeley's Landing, on Sebec Lake, a sawmill to replace the one destroyed by fire last month. The new mill will be 120 ft. long by 32 ft. wide and will be nearer the water's edge than the previous mill. A boiler house of grout and iron will be built entirely separate from the sawmill and will be fireproof. The engine in the old mill may be repaired, a 100-HP. boiler will be added and the plant will be equipped throughout with modern machinery. The building is to be 40 ft. longer than the old mill and it is expected the output will be about double that of the original plant. The company now has a portable mill getting out the lumber needed for the new structure and it is hoped to have the plant in running order during the coming winter. An addition to the boarding house is contemplated.

MANCHESTER, CONN.—Charles B. Schoenmehl, of Waterbury, Treas. and Gen. Mgr. of the Waterbury Battery Co., has bought the plant formerly occupied by the Eastern Biscuit Co. The plant will be renovated and put in condition for manufacturing operations.

BRIDGEPORT, CONN.—The Bridgeport Silverware Co., Bridgeport, Conn., is having plans drawn for an addition to its plant. The structure will be three stories high, of brick, 30 × 100 ft. There will be a wing, which will be used for power purposes. The Macfarlane Bros. Mfg. Co., makers of silverplated ware, will erect a 3-story brick factory also on State St. in that city. The building will be 50 × 200 ft.

ST. JOHNSVILLE, N. Y.—Chas. E. Cronk, Arch., Herkimer Bank Bldg., Herkimer, N. Y., is preparing plans for a factory building for Roth & Englehardt, piano manufacturers, Division St., St. Johnsville. The building will have two stories, 34 × 480 ft., brick and mill construction, and slag roof, etc. It is to be used for manufacture of piano actions. Bids will be called for on building in about 60 days.

ROCHESTER, N. Y.—Contract has been let by J. Foster Warner, Arch., Granite Bldg., Rochester, to FRED C. SEITZ for a factory building for the Rochester Box & Lumber Co., to cost $40,000.

CANASTOTA, N. Y.—Richard Heim and associates, of Fabius, N. Y., are having plans prepared by Thurber J. Gillette, Arch., 811 Park St., Syracuse, N. Y., for a 3-story factory building to be built here.

NIAGARA FALLS, N. Y.—It is stated that plans have been filed by the Development & Funding Co., Buffalo and Union Sts., to erect a steel and concrete addition to its plant at a cost of $24,000.

NEWARK, N. Y.—Bids are asked by C. W. Winspear, Supt. New York Custodial Asylum, at Newark, until Sept. 17, for enlarging bakery and constructing new oven for the N. Y. State Custodial Asylum. Franklin B. Ware, is State Arch., Albany.

NEW YORK, N. Y.—We are officially advised that the AMERICAN MACHINERY CO., 651 West 43d St., has secured contract to construct and equip two 2-story buildings in Brooklyn for the Vitagraph Co. of America, 116 Nassau St., New York. The buildings will cost $25,000 and the machinery $25,000. William L. Stoddart, 33 East 17th St., New York, is Arch.

ELIZABETH, N. J.—The Richard D. Kimball Co., 437 Fifth Ave., New York, let general contract to J. W. BISHOP CO., 345 Fifth Ave., New York, for a 2-story factory building, at Elizabeth, for Jenkins Bros., New York. Cost, $30,000.

BALTIMORE, MD.—The Baltimore Retort & Fire Brick Co., Hull and Nicholson Sts., Locust Point, whose plant was recently destroyed by fire, will start today to rebuild the plant. The new building, which will be two stories high, will be erected on a lot 200 to [illegible] WALSH & SON, 1525 Maryland Ave., are the builders. It will be built of brick, on concrete foundation and will be of brick and cement supported by hardwood columns. The plant will again have an aggregate an outlay of $9,200.

Ludwig Sellmayer, 907 North Broadway, E., has awarded contract to John Peters, 33 Vansant Bldg., Baltimore, for a store and cold-storage plant addition of Canton Ave. and Third St., 43 × 58 ft., 2 stories, of buff brick front and sides. Cost, $15,000.

BEDFORD CITY, VA.—The Bedford City Mills Co., has decided to build an addition to its present plant, 77 × 55 ft., to be equipped with woolen machinery. The company is operating about 2,000 spindles and 25 looms. Besides the addition, it is reported that a number of improvements will be made to facilitate increased output.

BROOKE, VA.—The Austin Run Mining Co., Harrison Bldg., Philadelphia, Pa., is reported to be planning to install power plant at Brooke, for operating its iron pyrites mines. The plant is to include a 70-HP. steam engine, 100-HP. boiler, air compressor, air drills, hoisting engine, etc.

BOULEVARD, VA.—George Brown, Norfolk, Va., will establish barrel, crate and veneer factory at Boulevard. Two 100-HP. boilers, two 50-HP. engines, sawmill, planers, veneer and stave machinery will be installed.

PORTSMOUTH, VA.—The Parker Hosiery Mills & Dye Works, Joseph A. Parker, Proprietor, Portsmouth, Va., will erect new buildings to replace those now in use. R. C. Bibberstein, of Charlotte, N. C., will furnish the plans. The new buildings will be of brick fireproof construction, costing about $20,000. They will include main knitting mill, 160 × 60 ft., two stories; dye house, two stories, 40 × 115 ft.; and boiler and engine house 50 × 60 ft. Mr. Parker intends to remove his present machinery to the new buildings, add some equipment and operate by electricity. He now has 60 knitting machines with accompanying apparatus, manufacturing seamless ribbed hosiery. Further details will be announced soon.

ROCK HILL, S. C.—It is reported that the management of the Hamilton-Carhart Cotton Mills, of Rock Hill, S. C., is planning to double the equipment of machinery. This would mean an expenditure of about $100,000, as the plant is operating 7,488 ring spindles, 101 broad looms, 103 narrow looms, and accompany machinery. The plant produces denims, which are dyed and finished at Rock Hill. Hamilton Carhartt, Tenth St. and Michigan Ave., Detroit, Mich., is Pres.

ATLANTA, GA.—The Southern Cotton-Stalk Pulp & Paper Co., Candler Bldg., plans to establish a number of mills in the cotton belt for manufacturing pulp and paper from cotton stalks. It will use a process invented by W. H. Croll. The company's officers are W. E. McMillan, Pres.; W. N. Shute, Vice-Pres.; Hutson Lee, Secy.-Treas. Company is capitalized at $500,000, and W. H. Croll is one of the directors.

TAMPA, FLA.—The Tampa Fertilizer Co., W. B. Chisholm, of Charleston, S. C., Pres., awarded contract to AULICK & DERATT, Tampa, for erection of a fertilizer factory. It will be "L" shaped, 380 × 80 ft., timbers covered with rubberoid roofing. Cost of building, $12,000. The Atlantic Coast Line will construct a private spur to property.

SELMA, ALA.—It is reported that work will begin soon on the roundhouse for the Louisville & Nashville R. R. Co. which is planned to be erected on a plot of ground purchased about a year ago. A turntable is being constructed on the site at present, and it is expected that as soon as the work on the turntable is finished the roundhouse and machine shops will be erected. Selma is in the center of the Myrtlewood and the Pensacola divisions. It is anticipated that the Louisville and Nashville will build a road to the coal fields up the Cahaba valley eventually and there will be additional needs for shops here. W. H. Courtenay, Louisville, Ky., is Ch. Engr.; T. H. Curtis is Superv. Machinist, Louisville.

GAYLESVILLE, ALA.—It has been stated that the Gaylesville Cotton Mills, of Gaylesville, Ala., will increase its equipment. This company was organized some time ago and delayed its plans owing to the financial situation. It contemplates building a mill capable of housing an equipment of from 4,000 to 5,000 spindles, to be operated by steam power on the production of cotton yarns. It is reported that plans and specifications are being prepared under the direction of E. J. Chestnut, Secy. The enterprise is capitalized at $100,000. J. R. Henderson.

HAMMOND, LA.—It is reported that A. Monteleone and Thomas J. Kelly, of New Orleans, La., are planning organization of a company to build a $150,000 sugar refinery at Hammond.

NEW ORLEANS, LA.—Swift & Co., Chicago, Ill., will erect a packing plant at New Orleans. The structure will occupy site 15,000 sq. ft. and will cost, including machinery, about $500,000.

ZANESVILLE, OHIO. — Improvements which mean the expenditure of $40,000 and an added capacity of 30% will be made at the Townsend brick plant, beginning the first of the year. The company will erect two kilns, one new factory building, and a power plant, with several needed minor structures, to carry on their immense business. The factory will be built completely of steel and brick and will be fireproof. It will have a daily capacity of 11,000 paving blocks.

RAVENNA, OHIO.—George S. Rider & Co., Engrs., Century Bldg., Cleveland, has let general contract to the HUNKIN BROS. CONSTRUCTION CO., 810 Cuyahoga St., Cleveland, for a 1-story dye house, at Ravenna, for the Cleveland Worsted Mills Co.

CLEVELAND, OHIO.—The Peerless Motor Car Co., 2429 East 93d St., proposes to double the capacity of its plants during the next two years. The McGeorge Engineering Co., Century Bldg., will prepare the plans.

INDIANAPOLIS, IND.—The Link Belt Co., chain manufacturers, has purchased a 20-acre site upon which to erect a plant to include stock and office building and two foundry buildings, each 800 × 100 ft. Estimated cost, $200,000.

RICHMOND, IND.—The Rahn Carpenter Co., Short Grove and Girard Aves., of Cincinnati, Ohio, has procured a site in this city upon which to build three factory buildings. Bids will be asked for soon. The company manufactures wood working machinery.

ANDERSON, IND.—J. R. Weaver, Arch., 1241 Fletcher Ave., Indianapolis, Ind., has completed plans for a 3-story factory building and a 2-story factory and office building, to be built at Anderson, for the Jenney Electric Mfg. Co., Indianapolis. Cost, $30,000 and $20,000, respectively. Charles D. Jenny is Pres.

SOUTH BEND, IND.—The officials of the Sibley Machine Tool Co. announce that they will build an addition, 118 × 84 ft. to the plant. The building will be brick, two stories high.

CHICAGO, ILL.—Work will be begun on the $500,000 tobacco manufacturing plant of Spaulding & Merrick, 271 Michigan Ave. It will employ 1,000 men at the start. The site is at 43d St. and Colorado Ave.

A smelting plant is to be erected at Lowe Ave. and 41st St., it is stated, by the Great Western Smelting & Refining Co., 185 West Kinzie St. The principal structures will be a 1-story building, 130 × 400 ft.; a 1-story foundry, 60 × 160 ft.; a 1-story smelter, 50 × 400 ft., and a refining plant, 40 × 360 ft. All of the buildings will be of reinforced concrete. Charles Reitler is Pres.; David Blum, Secy.

MINNEAPOLIS, MINN.—Press reports state that Armour & Co., 205 LaSalle St., Chicago, Ill., intend to construct a plant here to cost $2,000,000. B. F. Nelson is Pres. of the Commercial Club, Minneapolis.

DULUTH, MINN.—The Consolidated Elevator Co. has awarded the contract to erect a concrete and tile grain elevator on Rice's Point on the site of the burned elevator "D" to BARNETT & RECORD, Lyceum Bldg. It is stated that the capacity of the elevator will be about 1,400,000 bushels, and the cost about $1,000,000.

WICHITA, KAN.—Poenish Bros., the owners of the Banner Mills, which were destroyed by fire recently, have completed arrangeemnts for rebuilding.

FORT LEAVENWORTH KAN.—The C. W. RAYMOND CO., of Duluth, Minn., has secured the contract to install at the U. S. Military Prison at Fort Leavenworth a brick-making plant to cost $21,201.

KANSAS CITY, MO.—Sheppard & Farrar, Archs., Minor Bldg., Kansas City, have let general contract to ALEXANDER KINGHORN, for constructing a 3-story factory building for the Irving Pitt Mfg. Co. Cost, $40,000.

ST. LOUIS, MO.—The Century Art Glass Co. is having plans prepared for a 1 and 2-story factory building to cost $15,000. T. R. Lowther is interested.

BONHAM, TEX.—R. E. Medford & Co. will erect and equip an ice plant here. The building will be of mill construction and will cost $80,000; the machinery will cost $150,000. Contracts will be let in January.

BEAUMONT, TEX.—The Jefferson County Rice Land & Milling Co., organized with $100,000 capital stock, to take over properties of Nederland Rice Milling Co., has awarded contract to PHILIP RAHM, Bienville St., New Orleans, La., for installation of new machinery, repairs and remodeling of plant. Elevators for handling rice in bulk will be operated by steam power and a Corliss engine will be installed. E. Rockhill, Nederland, Tex., is Mgr.

WAGONER, OKLA.—The Missouri, Kansas & Texas Ry. System, S. B. Fisher, Chief Engr., St. Louis, Mo., will erect a 24-stall roundhouse and machine shops, 300 × 420 ft., at Wagoner.

ALBANY, ORE.—O'Shea Bros., of Portland, Ore., will build a meat packing plant in Albany to cost $250,000. Negotiations for a site are under way.

SACKVILLE, N. B.—The enterprise Foundry Co. of St. John, N. B., will rebuild its plant at once. The two main buildings each are to be 200 ft. long with monitor roofs, brick walls and cement floors.

SHERBROOKE, QUE.—The Improved Paper & Machine Co., of Nashua, N. H., manufacturers of paper and pulp-making machinery, will erect a plant at Sherbrooke, Que., under the name of the Sherbrooke Machine Co.

BARRIE, ONT.—The Grand Trunk Ry. System purpose erecting a $150,000 car shop and repairing plant at Barrie, Ont. W. D. Robb is Supt. of Motive Power, Montreal, Que.

ST. BONIFACE, MAN.—Swift & Co., of Chicago, in connection with the Canadian Pacific Ry., the Grand Trunk Pacific Ry., and the Canadian Northern Ry. companies, it is said, have purchased 200 acres of land in St. Boniface, on which they will erect an abattoir and lay out a stock yard on a large scale. The expenditure is to be over $1,000,000.

MOOSE JAW, SASK.—The Prague Flour Mills, Moose Jaw, Sask., will be enlarged from a 300 to a 1,000 barrel mill. An elevator and an oatmeal mill will be erected by the company also.

VICTORIA, B. C.—A $20,000 plant for the manufacture of white lead will be erected by F. W. Morris, of this city.

MISCELLANEOUS CONTRACTS.

(denotes that this work is advertised in Engineering News.)*

U. S. RECLAMATION SERVICE.—Items regarding irrigation, canal projects, etc., will be found under Water Supply—Irrigation.

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*VAULT.—Washington, D. C.—See item under Buildings.

RETAINING WALL.—Waterbury, Conn.—FRANK D'ANNA, Waterbury, has been awarded contract for building the Clark St. retaining wall, at $11,080.

STREET SIGNS.—Chicago, Ill.—Bids will be received until Sept. 21 by Wm. Carroll, City Electrician, for furnishing and placing street signs on certain streets of the city.

DAM.—Dayton, Ohio.—Bids are asked until Sept. 12 by the Board of Public Service, W. A. Budroe, Clerk, for improving and extending Riverdale dam.

*DREDGING.—Norfolk, Va.—Bids are asked by Maj. Jos. E. Kuhn, Corps Engrs., U. S. A., Norfolk, until noon, Sept. 30, for dredging Nansemond River, Va.

DITCH.—Montevideo, Minn.—Contract for constructing Judicial Ditch No. 2 (bids received on Aug. 27) has been awarded to JERRY SHERWOOD, of Litchfield, Minn.

*DREDGING, EXCAVATION.—Chicago, Ill.—Bids are asked until 10 a. m., Oct. 4, by Col. M. H. Bixby, Corps Engrs., U. S. A., for dredging and rock excavation in Chicago River, Ill.

DITCH.—Cerro Gordo, Ill.—Bids are asked until Oct. 8 by the Town Clerk, for construction of ditch. Estimated quantity to be excavated, 60,000 cu. yds. W. J. Day, Bement, Ill., is Engr.

*WHARF, SEAWALL..—Mobile, Ala.—Bids are asked until 11 a. m., Oct. 9, by Maj. H. Jervey, Corps Engrs., U. S. A., for construction of a wharf and seawall at Fort Gaines, Dauphin Island, Ala.

STEAMER ROLLERS.—Chicago, Ill.—Bids are asked until 11 a. m., Sept. 14, by the Department of Public Works for two steam road rollers. John J. Hanberg, Comr. Pub. Wks.

MOVING TOWER.—Wilmington, Del.—Bids are asked by the Light-House Engineer until 11 a. m., Sept. 12, for moving the tower at Schooner Ledge Range Rear Light-Station, Pa.

DAM.—Dayton, Ohio.—Bids are asked by the Board of Public Service until noon, Sept. 12, for improvement of the Riverdale Dam; also for repairing old dam. W. A. Budroe, Clk.

DITCH.—Salem, Neb.—Bids will be received until Sept. 18 by R. E. Grimstead, Drainage Comr., Richardson County, for constructing a ditch 18 miles long in Nemaha Valley. Estimated cost, $275,000.

TILE DRAIN.—Sac City, Iowa.—Bids are asked until Sept. 15 by the Supervisors of Calhoun and Sac Counties, at the office of J. J. Harter, Auditor of Sac County, at Sac City, for constructing a tile drain.

*ROCK EXCAVATION.—Boston, Mass.—Bids are asked until noon, Oct. 5, by Lieut.-Col. Edw. Burr, Corps Engrs., U. S. A., for 581½ cu. yds. rock excavation in Beverly Harbor, Mass.

IRON FENCES.—New York, N. Y.—Bids are asked by the Department of Parks until 3 p. m., Sept. 17, for furnishing and erecting wrought iron fences around such portions of St. Mary's Park, Boro. of the Bronx, as are not already fenced.

MINING EQUIPMENT.—Hibbing, Minn.—The Tod-Stambaugh Co., Perry-Payne Bldg., Cleveland, Ohio, has awarded contract to JOHN W. WEAVER, of Cleveland, for equipment of new iron ore mine near Hibbing. Estimated cost, $500,000.

BREAKWATER.—Bary, Ind.—The U. S. Steel Corporation has awarded to the GREAT LAKES DREDGING & DOCK CO., of Chicago, Ill., the contract for constructing a breakwater at Bary, about 3,200 ft. in length. Estimated cost, $1,000,000.

DITCHES.—Fairfield, Ill.—The Commissioners of the Woods and Randolph drainage ditches have awarded contract for digging 11½ miles of ditches in Wayne and White Counties to LEACH BROS., of Golden Gate, Ill., for $32,000.

ROCK REMOVAL.—Boston, Mass.—Bids will be received by the Board of Harbor and Land Commissioners at Room 131, State House, Boston, Mass., until 2 p. m., Sept. 11, for removing rock from Rockport Harbor. Frank W. Hodgdon, Ch. Engr.

DRAINAGE.—Champaign, Ill.—Bids will be received until Sept. 12 by the Commissioners of Kaskaskia, Special Drainage District, at the office of Ray & Dobbins, Attorneys, Champaign, for drainage work in this District. Abram Christ, of Champaign, Comr.

DITCH.—LeRoy, Ill.—Bids will be received until Sept. 15 by the Commissioners of Fairview Drainage District, at Le Roy, for furnishing about 20,000 ft. of tile, as well as the excavation of about five miles of ditch, hauling, covering, etc. Owens & Owens, Attorneys, Le Roy.

DITCHES.—Morrison, Ill.—Bids will be received until Set. 12 by the Commissioners of Enterprise Drainage District at the office of McCalmont & Ramsay, Attorneys, Morrison, for constructing ditches, requiring the removal of about 111,048 cu. yds. of material. John D. Arey, Engr., Sterling, Ill.

HEADSTONES.—New York, N. Y.—Bids are asked by Bird S. Coler, Pres. Boro. Brooklyn, until 11 a. m., Sept. 16, for furnishing and erecting 100 headstones over the graves of deceased veteran Union soldiers, sailors and marines, as provided by law, in the several cemeteries, situated in the counties of Kings and Queens.

CONCRETE DAM.—Front Royal, Va.—Bids were received on Aug. 18 for construction of concrete dam 260 ft. long and 10 ft. high on Shenandoah River. W. J. Kendrick, Recdr. Contract has been let to the MATHEWS-CURTIS CO., Front Royal. Estimated cost, $8,000.

SALE OF TUG.—Boston, Mass.—Bids will be received until 11 a. m., Sept. 16, by Depot Q. M., 263 Summer St., Boston, for the sale of the Quartermasters' Department tug "Captain Reilly," which can be seen at Commercial Wharf, this city. Terms: Cash in U. S. currency on day of sale.

DREDGING.—Brooklyn, N. Y.—Bids will be received until noon, Sept. 16 (extension of date), by Bird S. Coler, Boro. Pres., for furnishing material and dredging Gowanus Canal, from Section No. 4 + 50 to Station No. 32. Engineer's estimate: 9,000 cu. yds. scow measurement.

DITCHES.—Fulton, Ill.—The Commissioners of the Cattail Drainage District, Fulton, have let contract for the construction of the proposed ditches of said Drainage District, requiring the removal of approximately 300,158 cu. yds. of material, to A. R. PUTNAM, Fulton, at 6.195 cts. per cu. yd. Noted on Aug. 27.

*TILE DRAINS.—Beardstown, Ill.—Bids will be received by the Commissioners of the Coal Creek Drainage and Levee District, Beardstown, Ill., until 10 a. m., Sept. 29, for furnishing the tile and for laying the same. For quantities see advertisement in this issue. The Harman Engineering Co., Engrs., 120 Fredonia Ave., Peoria, Ill.

BRICK TUNNEL.—Buffalo, N. Y.—Bids were received on Sept. 1 by Francis G. Ward, Comr. Public Works, for constructing two brick tunnels under the tracks of the N. Y. C. & H. R. R. R., near the north end of the pumping station, Bureau of Water. Contract has been let to DARK & CO., Buffalo. Estimated cost, $9,000.

LEVEE.—New Orleans, La.—Bids will be received until 11 a. m., Sept. 18 by the Mississippi River Commission, Fourth District, 1539 Louisiana Ave., New Orleans, for constructing about 167,000 cu. yds. of new levee in Pontchartrain Levee District. Also separate bids for 37,000 cu. yds. of earthwork in the Lake Borgne Levee District. Address Capt. Harry Burgess, Corps Engrs., U. S. A.

CEMENT PLANKS, ETC.—New York, N. Y.—Bids are asked until 2 p. m., Sept. 17, by John F. Ahearn, Presh. Boro. Manhattan, for furnishing and delivering 50 yds. best Cow Bay sand, 40,000 best North River hard brick; 200 bbls. Portland cement; 75 bbls. Rosendale cement; 200 best spruce planks, 2″ × 9″ × 13′; 50 best spruce planks, 9″ × 1¼″ × 13′; 50 best spruce strips, 2″ × 4″ x 13′.

DREDING OUTFIT WANTED.—Battle Creek, Mich.—The Board of Public Works of Battle Creek, Michigan, desires to rent a dredge bucket, etc., holding about one-half yard, or to let contract for furnishing machinery and dredging trench in Goguac Lake for laying new inlet pipe in shallow water; small job. Address W. W. Brigden, Engr. and Supt.

LEVEE.—Alexandria, La.—Bids were received by the Red River, Atchafalaya and Bayou Boeuf Levee Board on Aug. 25 for raising and enlarging levees in Avoyelles Parish, from Egg Bend to Choctaw Bayou, and from Choctaw bayou to Moncia, work comprising about 275,000 cu. yds. Contract has been let to F. T. CONSTANT, Bunkie, La., on the following bids: 165,000 cu. yds. at 12.7 cts., and 110,000 cu. yds. at 17.23 cts.

FUEL OIL.—Phoenix, Ariz.—The Secretary of the Interior has approved the contract entered into by Louis C. Hill, Supervis. Engr. in the Reclamation Service, on behalf of the United States, and the PIONEER & CONSOLIDATED TRANSFER & STORAGE CO., of Phoenix, Ariz., for furnishing and hauling about 33,000 barrels of fuel oil for use in the cement mill, Salt River irrigation project. The estimated total amount of the contract will be $145,200.

*MODEL CASES.—Washington, D. C.—Bids are asked by the Department of the Interior, Washington, until 2 p. m., Sept. 21, for the purchase of 301 discarded model cases which have been in use by the U. S. Patent Office for the exhibition of models, and are adapted for display of specimens and goods. The sides, including doors, of cases are of glass; framework of some wrought iron; some of finished wood; sizes vary from about 19 ft. × 4 ft., × 8 ft. high to 8 ft. × 4 ft. × 4 ft. high.

LEVEE.—New Orleans, La.—Bids were received on Aug. 24 by Lieut. Wildurr Willing, Corps Engrs., U. S. A., of the Mississippi River Comn., Fourth Dist., 1539 Louisiana Ave., New Orleans, for constructing about 189,500 cu. yds. new levee in the Lower Tensas and Pontchartrain Levee Districts. The following bids were recommended for acceptance: Horner Levee, 73,000 cu. yds., to Dorovan & Daley, Lake Providence, La., at 24.7 cts. per cu. yds.; Revenue Levee, 116,500 cu. yds., to Gibson & Hale, Natchez, Miss., at 18.49 cts.

NAVAL SUPPLIES.—Vallejo, Cal.—Bids are asked by the Bureau of Supplies and Accounts, Navy Dept., Washington, D. C., until 10 a. m., Sept. 15, to furnish at the Navy Yard, Mare Island, Cal., a quantity of naval supplies, as follows: Schedule 180: locomotive crane. Schedule 190: locomotive. Schedule 191: lathe. Schedule 211: steam hammer. Schedule 220: transformers. Schedule 221: cable. Schedule 243: steel, wagon parts, steel wheelbarrows, leather. Schedule 244: conduit clamps. Applications for proposals should designate the schedules desired by number.

STEEL FILE-CASES.—New York, N. Y.—Bids are asked by John F. Ahearn, Pres. Boro. Manhattan, until 10 a. m., Sept. 18, for furnishing and erecting steel file-cases in the office of the County Clerk, in the Hall of Records Building, Borough of Manhattan, and for other furnishings required for this office; with the repairs and alterations, and the material and labor required for alterations; also for extension to the electric lighting equipment, and for carpenter and cabinet work, hardware, metallic and other furniture, electric light work, lighting fixtures, marble and bronze work, paintings, plastering and other work required to be done in connection with, and for the purpose of furnishing and erecting such steel file-cases and such other furnishings required.

*CANAL.—Portland, Ore.—Bids were received as follows on Aug. 31 by Maj. J. F. McIndoe, Corps Engrs., U. S. A., Portland, Ore., for constructing a portion of the Dalles-Celilo Canal, Columbia River: North American Dredging Co., Portland, Ore., $722,420; Puget Sound Bridge & Dredging Co., Seattle, Wash., $716,348; Johnston P. Porter, Vancouver, Wash., $756,190; Celilo Construction Co., Portland, $802,330; Robert Wakefield & Co., Portland, $802,370; Caughren, Winters, Smith & Co., Spokane, Wash., $530,005; Twohy Bros., Spokane, $643,385.

TUNNEL.—Marshall, Colo.—Bids will be received until Sept. 15 by the Denver Reservoir Irrigation Co., 701 Ideal Bldg., Denver, for the enlargement of the Community Tunnel, located near Marshall, on the C. & S. R. R.; 11,000 ft. of tunnel is to be enlarged, involving approximately 1,700 yd. of tunnel excavation and placing 1,500 yds. of concrete; also separate bids, same time and place for the enlargement of four miles of the Community Tunnel ditch, involving the excavation of about 60,000 yds. of material, including the placing of concrete drops and other canal structures.

AUTOMOBILE.—Cincinnati, Ohio.—Bids are asked by the Board of Public Service until noon, Sept. 15, for furnishing an automobile for the City Engineering Department; each bidder to submit his own specifications meeting the following requirements: One 5-passenger touring car complete, 40-45-HP. motor; cylinders must be cast in pairs and water jacketed; motor must be four-cylinder, four-cycle and of the water-cooled type with side valves; motor must be manufactured by same concern which assembles car; ignition of the jump-spark type; transmission must be sliding gear selective type three speeds forward and one reverse.

BARGE CANAL.—Albany, N. Y.—The Canal Board at its meeting held on Sept. 1, approved the plans and specifications, presented by State Engineer Frederick Skene, for five additional contracts for Barge Canal construction, as follows: Contracts Nos. 40, 41, 46, 47 and 68. Contract No. 40 is for the construction of the Erie Canal from Lockport to Sulphur Springs Guard Lock, a distance of about five miles; Contract No. 41, for building embankments at Irondequoit Creek crossing; Contract No. 46, for the construction of the canal from Fix Ridge to the southeast corner of the town of Galen, Wayne County; Contract No. 47, for the construction of the canal from the southeast corner of the town of Galen to a point near the New York Central Railroad crossing at Lyons, Wayne County; and Contract No. 68, for constructing in the Hudson River, Lock No. 3 at Mechanicville; Lock No. 4 at Stillwater; and Lock No. 5 at Northumberland, together with accompanying land lines and all appertaining construction. The approximate cost of the work is $7,000,000. It is expected that within a month bids will be asked for on the work.

*CABLE.—Washington, D. C.—Bids were received as follows on Aug. 28 by the Commissioners of the District of Columbia for furnishing underground signal and telephone cable for the Electrical Department of the District of Columbia: (A) 10,000 ft. three-pair combination cable, rubber insulated; (B) 5,000 ft. five-pair rubber insulated combination cable; (c) 10,000 ft. eight-pair combination cable, paper insulated; (D) 5,000 ft. ten-pair combination cable, paper insulated; (E) 5,000 ft. twelve-pair combination cable, paper insulated; (F) 10,000 ft. thirty-pair combination cable, paper insulated: Standard Underground Cable Co., Pittsburg, Pa., (A) 11.4 cts.; (B) 15.1 cts.; (C) 11.4 cts.; (D) 13 cts.; (E) 14.4 cts. (F) 28.3 cts. John H. Roebling's Sons Co., Trenton, N. J., (A) 13.2 cts.; (B) 17.8 cts.; (C) 16.8 cts.; (D) 17.9 cts.; (E) 19 cts.; (F) 33.4 cts. National Electrical Supply Co., Washington, D. C., (A) 14 cts.; (B) 19 cts. Chesapeake & Potomac Telephone Co., Washington, D. C., (A) 15.4 cts.; (B) 20.9 cts.; (C) 11.7 cts.; (D) 13.2 cts.; (E) 14.7 cts.; (F) 27.7 cts.

Bids were received as follows at the office of the Chief Signal Officer, War Dept., on Aug. 28 for furnishing: (A) 5,500 ft. bituminize conduit, 2½-in. inside diameter, ⅝-in. wall; (B) 2,000 ft. B. M. creosoted plank, 12-ins. wide by 2 ins. thick, lengths not less than 12 ft, nor more than 16 ft. (Unit prices): Wm. Wirt Clark & Sons, 596 East Monument St., Baltimore, Md., (A) 5.5 cts.; delivery f. o. b. Washington, ten days. National Electrical Supply Co., Washington, D. C., (A) 4.38 cts.; delivery, f. o. b. American Conduit Co., Chicago, Ill., at once. Wyckoff Pipe & Creosoting Co., 50 Church St., New York, (A) 6 cts.; (B) $37 per M.; own specifications for (A) delivery, f. o. b. Portsmouth, Va., ten days. Geary County Lumber Co., Junction City, Kan., (B) $39 per M.; delivery f. o. b. Fort Riley or Junction City, in six days. Western Electric Co., 463 West St., New York, (A) 4.85 cts., f. o. b. Lawrence, Ind., or 4.35 cts. f. o. b. East Chicago, Ill., 10 days. American Conduit Co., 140 Nassau St., N. Y., (A) 4.5 cts, f. o. b. East Chicago, Ill.; or shipment immediately. M. B. Austin & Co., 137 West Jackson Boulevard, Chicago, Ill., (A) 4.5 cts, per ft., f. o. b. East Chicago, Ill., ten days. The Fibre Conduit Co., Orangeburg, N. Y., for furnishing (A) wall socket joint conduit 2½ × ¾ in., 5 cts. per ft.; for furnishing wall socket joint conduit, 2½ × ¾ in., 7.5 cts. per ft.; for furnishing wall screw joint conduit, 2½ × ⅝ in., 9 cts. per ft., crated, f. o. b. 20 days, Orangeport, N. Y.

CONTRACT PRICES.

(See also page 97.)

[Where * precedes item under Contract Prices the work was advertised in Engineering News.]

*CONCRETE CONDUIT.—New York, N. Y.—Bids were received by the Board of Water Supply on Sept. 1 for the construction of a 3-miles stretch of plain concrete conduit known as cut-and-cover aqueduct, 17 ft. high × 17½ ft. wide inside, approximately between Ireland Corners and New Hurley in the towns of Gardiner, Plattkill and Shawangunk, Ulster County, New York. J. Waldo Smith is Ch. Engr. of Bd. Bids in detail were as follows: (A) Remington & Sherman Co., 359 Broadway; (B) the ELMORE & HAMILTON CONTRACTING CO., 56 Tweedle Bldg., Albany, N. Y. (awarded contract); (C) David Peoples, 271 Broadway; (D) Hoffman Engineering & Contracting Co., 1116 Pennsylvania Bldg., Philadelphia; (E) Robert C. Storrie, Philadelphia; (F) Gore Engineering & Contracting Co., 206 Broadway; (G) Arthur McMullen, 13-21 Park Row; (H) Bellew & Merritt Co., Tuckahoe, N. Y.; (I) Rinehart & Dennis Co., Colorado Bldg., Washington, D. C.; (J) Richard E. Heningham, 1 Madison Ave.; (K) The Phoenix Construction Co., 41 Park Row; (L) Mason & Hanger Co. and David Lupton's Sons Co., 50 Church St., (M) Stewart-Kerbough-Shanley Co., 527 Fifth Ave., New York; (N) Butler Bros.-Hoffman Co., 70 Broadway; (O) The Clement-King Co., Land Title Bldg., Philadelphia; (P) Millard Construction Co., Pennsylvania Bldg., Philadelphia; (Q) The John J. Hart Co., 26 Broadway, New York; (R) Bowman Bros., Maryland St., New Port, Pa.; (S) The J. Connelly Construction Co., Baltimore; (T) Bunting Bull Co., Albany, N. Y.; (U) S. Pearson & Son, Inc., Pelham, N. Y.; (V) Hennessy Construction Co., Staten Island City, N. Y.:

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)		(K)
25,000 cu. yds. removal of top-soil	$0.46	$0.39	$0.60	$0.50	$0.30	$0.50	$0.40	$0.75	$0.60	$0	
390,000 " " open-cut excavation	.40	.45	.50	.59	.60	.52	.37	.47	.55		$0.46
300,000 " " refilling and embanking	.23	.25	.29½	.30	.25	.35	.25	.34	.35		.47
20,000 " " surface dressing and grassing	.40	.40	.50	.40	.45	.45	.50	1.00	.60		.32
80,000 " " concrete masonry for aqueduct in open cut	4.92	5.50	6.10	4.94	5.00	5.00	6.25	5.40	5.50		.52
2,500 " " concrete masonry for culverts, retaining-walls, etc.	8.00	5.50	6.10	4.94	7.00	5.00	7.00	6.00	6.00		5.35
108,000 bbls. Portland cement	1.45	1.55	1.65	1.50	1.60	1.60	1.60	1.75	1.60		6.50
2,500 cu. yds. dry rubble masonry and paving	3.00	3.00	3.10	3.25	3.00	3.00	3.50	5.00	5.00		1.67
250 " " crushed stone and gravel	2.00	1.75	2.30	2.50	4.00	2.00	2.50	3.00	2.00		3.10
450 " " surfacing permanent access road	5.00	2.00	2.00	4.50	3.00	2.50	2.50	4.00	2.00		2.90
300 " " surfacing macadam roads	5.00	2.00	7.00	3.50	4.00	3.00	4.00	4.00	3.00		3.78
1 sluice-gate	75.00	90.00	150.00	150.00	200.00	150.00	350.00	300.00	100.00		3.78
1 ton cast-iron pipes and special castings	100.00	90.00	100.00	100.00	100.00	100.00	100.00	90.00	100.00		115.00
2,000 lin. ft. vitrified pipe	1.50	.90	.95	1.00	1.75	1.50	1.50	1.50	2.00		92.00
100 M. ft. B. M. timber and lumber	40.00	50.00	60.00	50.00	50.00	50.00	50.00	50.00	60.00		.96
9,500 lin. ft. stone boundary walls	1.25	1.10	1.25	1.50	1.25	1.00	1.50	1.00	2.50		61.00
2,000 lin. ft. fences and guard-rails	.30	.30	.42	.25	.40	.30	.40	.35	.35		.97
120,000 lbs. steel for reinforcing concrete	.05	.04½	.04¼	.05	.05	.05	.05	.05	.06		.37
2,000 lbs. wrought iron, cast iron and steel	.06	.06	.10	.04	.10	.08	.06	.08	.06		.06½
1,000 lbs. bronze	.50	.48	.70	.35	.75	.50	.60	.60	.60		.06
Testing six portions of aqueduct	500.00	750.00	1,500.00	800.00	1,000.00	1,200.00	1,000.00	1,500.00	1,000.00	750	.46
1,200 lin. ft. of excess, testing portions of aqueduct exceeding 200 ft. in length	2.00	2.50	2.00	4.00	2.50	2.00	4.00	7.50	2.00	4	1,200.00
Moving Birch house (lump sum)	1,000.00	500.00	2,460.00	1,000.00	1,000.00	1,500.00	1,000.00	(500.00	1,000.00	500	2.30
Cleaning up (lump sum)	300.00	3,000.00	4,000.00	5,000.00	4,000.00	10,000.00	6,000.00	5,000.00	5,000.00	5,000	575.00
Total	$894,520	$933,867	$958,000	$966,005	$969,275	$970,735	$989,320	$1,025,150	$1,046,070	$1,052	5,750.00

	(L)	(M)	(N)	(O)	(P)	(Q)	(R)	(S)	(T)	(U)
25,000 cu. yds. removal of top-soil	$0.40	$0.60	$0.30	$0.45	$1.00	$1.00	$0.75	$0.60	$0	$0.30
390,000 " " open-cut excavation	.60	.60	.74	.60	.66	.77	.70	1.14	1	1.00
300,000 " " refilling and embanking	.30	.35	.25	.45	.30	.40	.30	.30		.49
20,000 " " surface dressing and grassing	.80	.50	1.50	.50	.50	.60	.25	.35		.70
80,000 " " concrete masonry for aqueduct in open cut	5.75	6.00	5.50	5.25	6.00	5.50	6.50	6.00	6	8.29
2,500 " " concrete masonry for culverts, retaining-walls, etc.	5.75	6.50	6.00	6.00	10.00	7.00	8.00	8.00	6	8.29
108,000 bbls. Portland cement	1.60	1.50	1.60	1.75	1.80	1.70	1.60	1.75	1	2.42
2,500 cu. yds. dry rubble masonry and paving	5.50	3.00	5.00	6.00	3.00	2.50	4.00	3.00	3	5.00
250 " " crushed stone and gravel	2.00	2.50	2.00	2.50	3.00	2.00	3.00	3.50	3	3.50
450 " " surfacing permanent access road	1.75	4.00	3.00	1.00	3.50	2.00	3.00	4.00	3	3.00
300 " " surfacing macadam roads	2.00	6.00	3.33	4.00	3.50	2.50	3.00	4.00	4	5.00
1 sluice-gate	100.00	75.00	100.00	150.00	100.00	100.00	100.00	100.00	120	50.00
1 ton cast-iron pipes and special castings	100.00	100.00	200.00	100.00	100.00	100.00	120.00	100.00	120	100.00
2,000 lin. ft. vitrified pipe	1.50	1.50	1.00	1.50	1.25	1.00	1.00	1.50	2	1.00
100 M. ft. B. M. timber and lumber	60.00	60.00	50.00	60.00	60.00	60.00	60.00	60.00	55	60.00
9,500 lin. ft. stone boundary walls	1.10	1.50	1.60	2.00	1.00	1.25	1.50	1.25	1	2.25
2,000 lin. ft. fences and guard-rails	.30	.30	1.00	.40	.40	.50	1.00	.50		.50
120,000 lbs. steel for reinforcing concrete	.05	.05	.03	.06	.05	.04	.05	.06		.04½
2,000 lbs. wrought iron, cast iron and steel	.06	.10	.05	.06	.10	.06	.06	.06		.15
1,000 lbs. bronze	.60	.50	.50	.60	.60	.50	.50	.75		.75
Testing six portions of aqueduct	1,000.00	800.00	500.00	1,000.00	1,000.00	500.00	1,000.00	1,000.00	1,400	5,000.00
1,200 lin. ft. of excess, testing portions of aqueduct exceeding 200 ft. in length	5.00	4.00	5.00	5.00	5.00	3.00	5.00	4.00	7	12.00
Moving Birch house (lump sum)	500.00	1,000.00	1,000.00	500.00	1,500.00	1,000.00	1,000.00	750.00	1,500	1,500.00
Cleaning up (lump sum)	5,000.00	5,000.00	5,000.00	10,000.00	7,000.00	5,000.00	5,000.00	10,000.00	15,000	5,000.00
Total	$1,057,282	$1,080,300	$1,087,949	$1,090,995	$1,138,975	$1,145,895	$1,161,640	$1,308,670	$1,396,940	$1,900,469

Time, 44 months. Bond required, $225,000. Engineer's estimate, $1,205,835.

DAM, SPILLWAY.—Orland, Cal.—Bids were received on Aug. 27 by the U. S. Reclamation Service, Orland, for the construction of East Park dam, spillway and dikes, located about 12 miles northwest from sites, Colusa County, Cal. D. C. Henry, Supervis. Engr.; T. H. Humpherys, Project Engr.; J. L. Rhead, Asst. Engr. Bids in detail were as follows: (A) Latus & Layaz, Oakland, Cal.; (B) the Daniel O'Day Co., San Francisco, Cal.; (C) the Stanley Contracting Co., San Francisco; (D) Edward Malley, Oakland; (E) the Standard Bldg. Co. and Lewis & Luce Co., San Francisco; (F) F. M. Butler, San Francisco; (G) the Globe Construction Co., San Francisco; (H) Union Iron Works, Los Angeles, Cal.; (I) Cotton Bros., Oakland; (J) Bates & Rogers Construction Co., Chicago, Ill.; (K) Burrell Bridge & Construction Co., Oakland; (L) the Summit Construction Co., San Francisco; (M) Maney Bros. & Co., Winnemucca, Nev.; (N) W. O. Morrison, Denver, Colo.; (O) Johnston P. Porter, Vancouver, Wash.; (P) the Hunkin Bros. Construction Co., Cleveland, Ohio:

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)	(L)	(M)	(N)	(O)	(P)
3,000 cu. yds. main dam exc., Class 1	$0.94	$1.50	$2.25	$2.00	$2.33⅓	$3.20	$2.65	$2.90	$8.00	$4.50	$2.50	$2.50	$5.25	$6.55	$6.00	$5.95
60 " " main dam exc., Class 2	2.96	10.00	3.12	4.00	6.00	5.00	5.00	8.00	24.00	15.00	30.00	6.00	5.00	6.50	20.00	5.95
265 " " main dam exc., Class 3	2.70	10.00	2.81	4.00	5.00	4.00	5.00	4.50	12.00	14.00	15.00	2.50	5.00	3.10	6.00	3.95
12,400 " " concrete	3.72	4.35	4.81	5.00	5.64	5.40	6.60	6.75	5.68	7.10	7.50	7.75	9.00	9.95	9.00	13.95
900 " " spillway & dikes exc., Class 1	.50	.25	.62½	.70	.25	.62	2.00	.50	1.20	.75	2.00	1.00	1.50	.80	1.25	.75
250 " " spillway & dikes exc., Class 2	1.00	1.00	1.25	1.00	3.00	1.88	3.00	3.00	3.00	2.50	5.00	2.50	5.00	2.10	6.00	2.45
1,090 " " concrete	5.19	4.45	6.37	8.00	5.00	11.10	8.50	10.50	9.90	9.00	7.50	13.00	9.00	8.90	17.50	13.95
4,000 " " earth in dikes	1.50	.25	.50	.70	.50	.94	1.50	1.00	1.80	1.00	2.00	1.25	.50	.48	1.75	1.04
700 pitching	2.00	2.00	1.50	2.00	1.00	3.15	3.00	2.00	4.00	1.50	2.50	3.25	3.00	3.65	5.00	1.39
25,000 lbs. handling gates, etc.	.02¾	.02	.06¼	.03	.04½	.02½	.03	.08	.02 9/10	.02	.10	10	.06	.01½	.10	.05
5,000 lbs. handling steel, etc.	.02	.01	.02½	.03	.03	.01	.02	.04	.01 9/10	.02½	.10	.06	.06	.01¼	.10	.03
Total	$64,383	$69,965	$79,882	$83,900	$89,021	$97,687	$112,180	$113,817	$122,463	$122,935	$130,250	$130,392	$147,285	$160,100	$167,500	$215,260

*LAYING WATER-PIPE.—Boston, Mass.—Bids were received on Sept. 2 by the Metropolitan Water and Sewerage Board for laying 12,400 lin. ft. of c.-i. water-pipe in Boston and Brookline, Mass. Henry H. Sprague is Chn.; Dexter Bracket is Ch. Engr. Water Wks., 1 Ashburton Pl., Boston. Bids in detail were as follows: (A) Frank Williams & Co., Boston; (B) BRUNO & PETITTI, Boston (awarded contract); (C) Byrne Contracting Co., Boston; (D) Coleman Bros., Boston; (E) Kennelly & Gaddis, Boston; (F) C. E. Trumbull Co., Boston; (G) Falvey & Kelly, Somerville, Mass.; (H) John A. Costello & Co., Roxbury, Mass.; (I) Boston & New York Construction Co., Boston; (J) James Driscoll & Son, Brookline, Mass.; (K) Hugh Nawn Contracting Co., Roxbury:

	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)	(I)	(J)	(K)
12,400 lin. ft. laying 48" c.-i. pipe	$2.30	$2.60	$2.68	$2.70	$2.88	$2.81	$3.00	$3.24	$3.60	$3.60	$4.25
100 lin. ft. laying 36" c.-i. pipe	1.50	2.00	2.50	2.50	2.79	4.00	3.00	3.00	2.50	2.50	3.00
100 lin. ft. laying 12" c.-i. pipe for blow-offs	.60	1.00	1.00	2.00	1.79	1.00	1.00	1.00	1.00	1.00	2.00
600 cu. yds. rock exc. above grade	2.00	3.25	4.00	4.00	3.85	5.00	4.50	3.00	3.00	2.00	4.00
10 cu. yds. rock exc. below grade	3.00	4.00	5.00	10.00	3.85	6.00	7.00	5.00	5.00	6.00	4.00
20 cu. yds. earth exc. below grade	.80	1.50	2.00	3.00	1.00	1.50	1.50	1.00	1.50	1.50	1.50
7 setting air valves	25.00	2.50	5.00	5.00	7.00	5.00	15.00	10.00	3.00	15.00	5.00
5 chambers for 30" valves	100.00	50.00	50.00	75.00	54.00	75.00	70.00	50.00	60.00	100.00	30.00
18 chambers for blow-offs, by-passes and air valves	80.00	35.00	35.00	50.00	38.50	50.00	40.00	25.00	35.00	70.00	20.00
100 cu. yds. concrete masonry	7.00	7.00	7.00	7.00	5.50	7.00	8.50	5.00	5.00	7.00	8.00
Total	$32,791	$36,157	$37,687	$38,500	$40,100	$40,444	$42,425	$43,716	$48,321	$48,845	$57,015

U. S. POSSESSIONS AND CUBA.

DUMP CARS.—Panama.—Bids will be received at the office of Cap. F. C. Boggs, General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until Sept. 21, for furnishing 200 dump cars, as per Circular No. 463.

*METAL WORK.—Hawaii.—Bids were received as follows by the Light-House Board, Washington, D. C., on Aug. 26, for furnishing the metal work for the tower for Makapuu Point Light-Station, Oahu, T. H.: Ellicott Machine Co., Baltimore, Md., $16,173; Hoisting Machine Co., New York, $12,000; Atlanta Machine Works, Atlanta, Ga., $14,288; Lynchburg Foundry Co., Lynchburg, Va., $8,965; Vulcan Iron and Steel Co., Milwaukee, Wis., $11,595; Champion Iron Works, Kenton, Ohio, $12,750.

ELECTRIC RAILWAY.—Panama.—Bids are asked by the Isthmian Canal Commission until Sept. 28th, at 10:30 a. m., at the office of the General Purchasing Officer, Washington, D. C., under Circular No. 465, for the construction of one complete electric industrial railway, which is to form a link in the Gatun Locks material handling plant for the haulage of construction materials to the various points of the work. The particular function of this electric railway is the transportation of newly mixed concrete in buckets from the mixer house to the lock cableways. The cycle of work will be practically as follows: an electric industrial locomotive is coupled up to two flat cars which carry one bucket each; both buckets receive concrete at the mixers, whence train runs to one of the duplex cableways; the cableway operators deposit two empty buckets on the cars and pick up the full buckets, which are conveyed to the lock wall forms; the train backs over the return track to the mixer house and duplicates the work cycle. The trackage, which is to be four tracks wide, each track 3,900 ft. long, is to be of the narrow-gage, third-rail type, the latter preferably of the under-running type, located between the track rails and with insulation such as will resist the disintegrating effects of continuous rain, dampness and insects. Tracks are to be laid 11 ft. apart between center lines with rails of standard 40-lb. type, laid with angle-bar connections. The Commission will furnish the ties. A train speed of ten miles per hour, full load on the maximum grade of 2.1%, is to be provided for. There are to be twelve electric locomotives operated under an electric pressure of 550 volts, D. C., of the single-truck, four-wheel mine locomotive type, designed for heavy-duty and continuous service, of a maximum height of 5 ft. 6 ins. and a maximum width of 6 ft. 6 ins., length to be about 12 ft. It is to be reversible, operating equally well in either direction. The motors are to be of the regular railway type, series wound, two in number, one on each wheel axle. Each locomotive is to draw two flat cars, each of which will carry one full concrete bucket. The average train-load will be 23,320 full, 4,000 empty. The cars are to be 7 ft. wide, and not more than 2 ft. 8 ins. high, with a train length of 18 ft. It is desired that the equipment be furnished and installed ready for operation in not more than seven months from date of contract.

CABLE RAILWAYS.—Panama.—Bids were received as follows on Aug. 31, at the office of Capt. F. C. Boggs, Corps of Engrs., U. S. A., Gen. Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for the construction of an electric or cable railway, traveling cranes and valves: Bids were asked as follows: Class 1, two cable railways, each about 4,700 ft. in length, with 68 grip cars, or Class 1, alternate, two electric railways of the same length, with one spur track, 600 ft. long, with 30 allsteel motor cars. The Commission has not decided whether it will purchase the cable railways or the electric. Class 2, ten two-ton traveling cranes; ten hoisting motors, ten bridge motors, ten trolley motors, 2,800 ft. cable runway, 1,400 ft. collector wires. Class 3, 52 stone valves, 28 sand valves, 58 cement valves. All these railways, etc., are to be erected on the Isthmus, and used for the construction of the locks and dam at Gatun.

Class 1: Atlas Car & Mfg. Co., 1289 Marietta Road, Cleveland, Ohio, alternate, $40,840, $39,022; time, 190 days. Bergen Point Iron Works, 149 Broadway, New York, $56,988; 210 days. Exeter Machine Works, Pittston, Pa., $53,660; 210 days. Mead-Morrison Mfg. Co., 11 Broadway, New York, $107,308; 210 days. E. K. Snodgrass, 95 Liberty St., New York, $39,940; 150 days. Wonham-Magor Engineering Works, Cleveland, Ohio, $45,524; 180 days, Class 1, alternate, $75,650, $63,300; 180 days.

Class 2: Alliance Machine Co., Alliance, Ohio, $57,824; 210 days. Cleveland Crane & Car Co., Wickliffe, Ohio, $31,000; 160 days. Manning, Maxwell & Moore, Inc., 95 Liberty St., New York, $35,764, not erected; 180 days. Maris Bros., 56th and Grey Ave., Philadelphia, $34,793; 210 days. Niles-Bement-Pond Co., 111 Broadway, New York, $36,120, $34,880, $34,270, $33,030, $33,270, $32,030, $31,060; 180 days. Wm. Sellers Co., Inc., 1600 Hamilton St., Philadelphia, $44,685. Sheperd Electric Crane & Hoist Co., Montour Falls, N. Y., $36,032; 150 days. Wellman-Seaver-Morgan Co., 50 Church St., New York, $52,100; 150 days, not erected.

Class 3, lowest bidder, New Jersey Foundry & Machine Co., 90 West St., New York, $2,662.

CONTRACT PRICES.

*REVETMENT, ETC.—Milwaukee, Wis.—Bids were received as follows on Aug. 26 by Maj. W. V. Judson, Corps Engrs., U. S. A., Milwaukee, for building plank crib revetment, removing old pier, and dredging at Manistique Harbor: (A) Columbian Construction Co., Muskegon, Mich.; (B) Greiling Bros., Green Bay, Wis. Itemized bids were as follows:

	(A)	(B)
354,000 ft. B. M. hemlock timber and plank, per M. ft.	$31.00	$30.00
8,500 ft. B. M. pine timber and plank, per M. ft.	40.00	40.00
17,000 lbs. wrought iron and steel screw bolts and wire spikes	.04	.04
7,500 tons of stone, per ton of 2,000 lbs.	1.05	1.25
5,300 cu. yds. back filling	.50	.50
80,000 cu. yds. dredging	.22	.19
Removing old pier, for the work	3,600.00	4,500.00
Total	$43,719	$43,365

PIERS.—Baltimore, Md.—Seven bids were received on Aug. 12 by the Board of Awards for constructing two pile and timber piers, known as Piers 7 and 8. Contract has been awarded to SANFORD & BROOKS CO., 15 South St., at $49,216. Their bid in detail was as follows: 1,739 yellow pine plumb piles, driven and cut off, $5.60 each; 265 yellow pine fender piles, $5.60 each; 110 spur piles, $5.60 each; 968 M. ft. B.M. yellow pine (Georgia) timber, $35 per M. ft.; 75,000 lbs. iron bolts and spikes, etc., 4 cts. a lb.; 10,000 lbs. c.-i. cleats, 4 cts. a lb.; 14 cu. yds. concrete 1:3:7, $7 per yd. Total, $49,216.

ASPHALT PAVING.—Memphis, Tenn.—Bids were received on Aug. 24 for laying 65,000 sq. yds. of asphalt paving on Madison Ave. J. H. Weatherford, City Engr. Itemized prices were as follows: (A) H. P. Streicher & Co., Spitzer Bldg., Toledo, Ohio, $136,350; (B) Barber Asphalt Paving Co., First National Bank Bldg., $174,150; (C) Memphis Asphalt & Paving Co., Tennessee Trust Bldg., Memphis, $158,250.

Grading, 40,000 yds. (A) 24 cts.; (B) 60 cts.; (C) 43 cts.

Concrete foundation, 65,000 yds., (A) 62 cts.; (B) 72 cts.; (C) 70 cts.

Asphalt top, 65,000 yds., (A) $1.28; (B) $1.49; (C) $1.42. Maintenance, (A) 5 cts.; (B) 10 cts.; (C) 5 cts.

Trees, (A) $5; (B) $8; (C) $5.

FOREIGN CONTRACTS.

(To insure prompt attention, letters upon consular business should be addressed to the American Consult at ———. Such letters are opened and attended to by the person that may be in charge of the office. If addressed to the consul, personally, letters are forwarded to him, unopened, should he be absent, and a delay thus intervenes. If, in the meantime, he should have gone out of office, the matter may wholly escape attention.)

(* *denotes that this work is advertised in Engineering News.*)

RAILWAY.—Brazil.—See under Railways.

RAILWAY CONSTRUCTION.—Bolivia.—See under Railways.

DRY DOCK.—Italy.—Bids are asked by the Ministry of Marine, Rome, until 6 p. m., Oct. 15, for the construction of a new dry-dock and for various alterations and extensions to the Royal Dockyard at Venice.

ADDRESSING CONSULAR OFFICERS.—With the many changes now occuring in the consular service the following statement by Consul Isaac A. Manning, at Cartagena, is timely: "The habit of American business concerns in addressing correspondence of a commercial character to consular officers in their own names makes it impossible for a new occupant of a post to distinguish between letters of a personal and letters of a public character which may come addressed to his predecessor. If the letters are of a personal nature, his successor does not desire to open them. If they are of a public character and are forwarded to the former consul at his new location, he is put to the unnecessary and sometimes burdensome expense of repaying postage thereon at the rate of 5 to 10 cents per half ounce on letters which interest him not at all in his new station. This also means delay in the correspondence and oftentimes loss of the letter. Commercial houses should address all mail simply 'American Consul-General,' 'American Consul,' etc., or in case of using the name of the consul, stamp or write the words 'official character' on all mail."

WATER-WORKS.—Spain.—Bids are asked until Sept. 12 for the extension of the water supply works of Zaragoza at an estimated cost of 3,066,822 pesetas (about $613,350). Bids will be opened at the Casa Ayuntamiento, Zaragoza. A deposit of 153,350 pesetas (about $30,650) will be required to qualify any bid. The estimated cost as given above includes the cost of the filters, i. e., 315,007 pesetas (about $63,000).

TRAMWAY.—Roumania.—Bids will be received until Oct. 14 for a concession for the construction of a tramway system for the city of Craiova. Bids must be accompanied by a surety of $1,000. For further direct information, correspondence should be addressed in French or German to Monsieur le Maire, Crajova, Roumania.

BRIDGE.—Egypt.—Bids are asked by H. E., the Minister of Public Works of the Egyptian Government, Cairo, until noon, Sept. 26, for the construction of a road-bridge over the Ismalia Canal at Cairo. Bids must be accompanied by a deposit of $2,500 (£E500).

CAISSON GATES.—Greece.—Bids are asked until noon, Sept. 12, by the Grecian Ministry of the Interior for the supply of two floating caisson gates of Siemens-Martin steel for two drydocks now under construction at the port of the Piraeus. Bids will be received by the Directeur des Travaux Publics, Athens. Local representation is desirable.

TRAMWAY.—Spain.—Bids will be received until Sept. 25, 1908, by the Direccion de Obras Publicas, Madrid, Spain, for construction and operating an electric tramway in Madrid. A deposit of $1,037 must accompany all bids.

TELEGRAPH AND TELEPHONE MATERIAL, POWER PLANT.—Australia.—Bids are asked for material as follows: Until 3 p. m., Sept. 22, to supply to the Deputy Postmaster-General, Melbourne, 8,700 black plugs and 6,250 white plugs.

Oct. 6 (noon).—Supply to the Deputy Postmaster-General, Perth, telegraph and telephone material.

Oct. 21 (noon).—Supply to the Deputy Postmaster-General, Adelaide, a power plant for charging accumulators for telegraph purposes.

Nov. 2 (noon).—Supply to the Deputy Postmaster-General, Hobart, material for accumulator equipment for telegraph purposes.

CIVIL SERVICE EXAMINATIONS.

EXAMINER OF SURVEYS.—Washington, D. C.—The U. S. Civil Service Commission announces an examination on Sept. 16-17, to secure eligibles from which to make certification to fill two vacancies in the position of Examiner of Surveys in the General Land Office Service, and vacancies requiring similar qualifications as they may occur in that service. Age limit, 20 years. Application Form 1312.

SURVEYOR.—Philippine Service.—The U. S. Civil Service Commission announces an examination on Sept. 23-24, to secure eligibles from which to make certification fill vacancies as they may occur in position of Surveyor in the Philippine Service, at an entrance salary of $1,400 a year. Field expenses are allowed appointees when absent on duty from their permanent station. Age limit, 18 to 40 years. Application Forms 2 and 375.

DRAFTSMEN, ETC.—Albany, N. Y.—The State Civil Service Commission will hold examinations on Sept. 26 for the following positions: Bridge Draftsman, $1,200 to $1,500; Junior Bridge Draftsman, $900 to $1,200; Superintendent of Publication and Compilation, Public Service Commission, Second District, $2,000. The last day for filing applications for these positions is Sept. 19. Charles S. Fowler, Ch. Examiner.

METALLURGICAL CHEMIST.—Watertown, Mass.—The U. S. Civil Service Commission announces an examination on Sept. 23 to secure eligibles from which to make certification to fill a vacancy in the position of chemist, $1,200 per year, Ordance Department at Large, Watertown Arsenal, Watertown, Mass., and vacancies requiring similar qualifications as they may occur in any branch of the service. Age limit, 20 years. Application Form 1312. Applications must be filed prior to closing on Sept. 12.

HYDROGRAPHIC DRAFTSMAN.—Washington, D. C.—The U. S. Civil Service Commission announces an examination on Oct. 7-8 to secure eligibles from which to make certification to fill a vacancy in the Coast and Geodetic Survey, Department of Commerce and Labor, at $900 a year, and vacancies requiring similar qualifications as they may occur in any branch of the service. Age limit, 18 years. Application Form 1312. Applications must be filed prior to closing hour on Sept. 28.

IRRIGATION ENGINEER.—Washington, D. C.—The U. S. Civil Service Commission announces an examination on Sept. 23-24, to secure eligibles from which to make certification to fill at least three vacancies in the position of Irrigation Engineer in connection with the Irrigation Investigation of the Office of Experiment Stations, Department of Agriculture, at salaries ranging from $1,500 to $2,000 a year, according to qualifications, and vacancies requiring similar qualifications as they may occur. Age limit, 20 to 50 years. Applications Form 1312.

EXAMINER OF ACCOUNTS.—Washington, D. C.—The U. S. Civil Service Commission announces the postponement to Oct. 7-8, of the examinations scheduled to be held on Sept. 3-4, to secure eligibles from which to make certifications for the appointment of Examiners in the Division of Accounts, Interstate Commerce Commission. The salaries will range from $1,800 to $3,000 a year, and traveling expenses will be allowed when away from Washington or other official headquarters. It is expected that approximately 75 appointments will be made if sufficient high-grade eligibles result from this examination. Owing to the Commission's inability to secure a sufficient number of competent applicants, qualified persons are urged to apply for this examination. The purpose of the examination is to establish registers of men with expert qualifications in the fields of railway or other common-carrier accounting. Age limit, 23 to 48 years. The applicant should be able to furnish bond with a reliable surety company to guarantee faithful service. Applicants should familiarize themselves with the Federal Act to Regulate Commerce, a copy of which will be furnished with the application. Application Form 304. Applications must be filed prior to closing hour on Sept. 28.

CIVIL ENGINEER.—Philippine Service.—An examination will be held on Sept. 16-17 by the U. S. Civil Service, to secure eligibles from which to make certification to fill vacancies as they may occur in the position of Civil Engineer in the Philippine Service. The entrance salary is usually $1,400 per year. There are, however, similar positions in that service paying higher salaries, and it is desired to secure from this examination eligibles who are qualified to fill the higher salaried positions in the event that vacancies therein occur. Appointees are allowed field expenses when absent on duty from their permanent station. As considerable difficulty has been experienced in securing a sufficient number of eligibles for this position to meet the needs of the service, qualified persons are urged to enter this examination. Age limit, 18 to 40 years. Application Forms 2 and 375.

INDUSTRIAL NOTES.

THE CLEVELAND CRANE & CAR CO., Wickliffe, Ohio, advises us that it has opened an office at 1203 Marquette Bldg., Chicago, Ill., with W. A. Rider in charge.

THE BAKER CONSTRUCTION CO., 90 West St., New York, advises us that on Aug. 26, the Ficklen Baker Construction Co. changed its name to the Baker Construction Co.

W. C. WEEKS, M. AM. SOC. C. E., who has just completed the big power plant for the Washington Water-power Co., at Post Falls, Idaho, has been elected Vice-President and General Manager of the International Contract Co., of Seattle, Wash.

JOHN F. ALLEN, 370-372 Gerard Ave., New York, builder of portable pneumatic riveting machines, reports a recent sale, through his Paris agents, Fenwick Freres & Co., of one "Allen" jaw riveter 25" reach, 15½" gap, 10" cylinder, to Stussi & Zweifel, Milan, Italy.

THE BUFFALO METER CO., Buffalo, N. Y., advises us that it has prepared index cards describing and giving prices of American and Niagara water meters, which will be sent to any engineer, water-works official, or dealers, for his files upon request.

THE MINNEAPOLIS SEWER PIPE WORKS has let the contract for the power equipment for its new plant at Hopkins, Minn., to the Minneapolis Steel & Machinery Co. The contract includes a 20 × 48" heavy duty Twin City Corliss engine, feed water heater, pumps, etc.

CROCKER-WHEELER CO., Ampere, N. J., has opened a new office in the Gumbel Bldg., Kansas City, Mo., for the sale of C-W motors, dynamos, transformers, switchboards, etc. The office is in charge of A. W. Paine, who will give personal attention to business in Kansas City and vicinity.

THE TACONY IRON CO. advises us that to concentrate the business and have a closer supervision over the operation of the foundry under its new manufacturing process, its executive offices will be located on and after Sept. 1, 1908, at the S. W. corner of Magee St. and State Road, Tacony, Philadelphia, Pa.

THE RAYMOND CONCRETE PILE CO., of New York and Chicago, has been awarded the contract for placing Raymond concrete piles in the foundations of the Frederick Grunden Branch Library, Cass Ave. and 14th St., St. Louis. Eames & Young are the architects, and the Murch Brothers Contracting Co., the general contractors for the work.

THE JACKSONVILLE ELECTRIC CO. has ordered through the Stone & Webster Engineering Corporation five semi-convertible, double-truck cars, equipped each with four 30-HP. motors. The length will be 44 ft. over the buffers. The cars will be built by the J. G. Brill Co., and will have Standard Motor Truck Co. trucks and General Electric motors and air brakes.

J. FRANK CASE, Asst. Secy. of the Norfolk & Southern Ry., resigned from that office on Aug. 1 to accept a position in the Railroad Sales Department of the National Paint Works of Williamsport, Pa. He will make his headquarters at the main sales office, 100 William St., New York City, and will especially attend to the New York City and New England railroad trade. The National Paint Works also have as Southern representative, W. B. Kilpatrick, who makes his headquarters at Washington, D. C.

THE TRAYLOR ENGINEERING CO., 2 Rector St., New York City, reports the following recent sales: Two 150-HP. Hawkes boilers for the U. S. Government hydraulic dredge "Peele." Two 175-HP. Hawkes boilers for the State Tubercular Institute, Mount Vernon, Mo. Two 200-HP. Hawkes boilers for the Southwestern States Portland Cement Co., Eagle Ford, Tex. Three 150-HP. Hawkes boilers for the School of the Sisters of Notre Dame, St. Louis, Mo. Three 150-HP. Hawkes boilers for the Plaza Hotel Chicago, Ill.

THE SANDUSKY PORTLAND CEMENT CO., Sandusky, Ohio, is furnishing several tons of waterproof compound, which is being used in connection with Portland cement for lining a shaft being sunk from the top of a hill into a railway tunnel at Wilkes-Barre, Pa. The work is being done by R. D. Isaacs & Son, contractors, at that place. The same company furnished their Medusa white Portland cement for the Government rifle ranges recently finished at Camp Perry, Ohio, which construction was done by the R. H. Aiken Engineering Co.; also for the new Senate Office Building at Washington, D. C.

THE COMPLETED EQUIPMENT of the new power house station for the Warrenton Woolen Co., Torrington, Conn., which is to be furnished in accordance with plans and

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*PAVING.—Port Chester, N. Y.—Bids were received on Aug. 10 for paving. J. A. Kirby & Son, Port Chester, are Engrs. and Surveyors. Bids in detail were as follows—(A) H. K. Stokes, 11 Pine St., New York; (B) U. S. Wood Preserving Co., 29 Broadway, New York; (C) F. E. Murray, 112 Purdy Ave., Port Chester; (D) Thomas M. Hart; (E) G. O. Merritt Co., 135 Horton Ave., Port Chester; (F) Warren Bros. Co., 253 Broadway, New York:

Paving Willett Ave.—	(A)	(B)	(C)	(D)	(E)	(F)*
2,000 cu. yds. earth excavation	$0.50	$0.65	$0.75	$0.50	$0.75	$0.55
5 " " rock excavation	2.25	1.50	2.50	2.50	2.75	1.50
25 " " rock in trench	3.00	2.25	3.25	3.50	3.25	2.25
15 " " crushed stone	1.90	1.50	.50	2.08	2.25	.50
7,300 sq. yds. bitulithic (concrete)	....	....	....	2.05	....	2.42
7,300 " " bitulithic (crushed stone)	....	....	....	2.05	....	2.30
7,300 " " brick (concrete)	....	....	2.50	....	2.63	....
7,300 " " wood (concrete)	3.15	2.85	....	....	....	....
125 " " brick (sand)	2.75	1.60	1.95	2.40	2.00	1.60
200 ft. new curb	.75	.60	.65	.90	.70	.65
3,100 " curb reset	.45	.22	.26	.35	.30	.26
400 " headers	.70	.60	.70	.90	.70	.65
72 " 10" c.-i. pipe	1.10	1.45	1.45	1.20	1.65	1.45
192 " 12" c.-i. pipe	1.50	1.60	1.65	1.40	1.80	1.60
270 " 10" vitrified pipe	.75	.65	.65	1.00	.90	.65
100 " 12" vitrified pipe	.85	.80	.80	1.20	1.00	.80
200 sq. yds. flag relaid	.30	.27	.27	.28	.35	.27
6 catch basins	60.00	95.00	95.00	120.00	110.00	95.00
Totals Bitulithic (concrete)	.....	.....	.....	$19,542	.....	$21,524
Bitulithic (crushed stone)	.....	.....	.....	$19,542	.....	$20,648
Brick (concrete)	.....	.....	$22,612	.....	$24,111	.....
Wood (concrete)	$27,353	$24,724	.....	.....	.....	.....

*Awarded contract.

Paving Highland St. and Locust Ave.—	(A)	(B)	(C)*	(E)	(F)
1,500 cu. yds. earth excavation	$0.55	$0.65	$0.75	$0.75	$0.55
5 " " rock excavation	2.25	1.50	1.50	2.75	1.50
25 " " rock in trench	3.00	2.25	3.25	3.25	2.25
15 " " crushed stone	1.90	1.50	2.25	2.25	.50
5,300 sq. yds. bitulithic (concrete)	....	....	....	....	2.42
5,300 " " bitulithic (crushed stone)	....	....	....	....	2.30
5,300 " " brick (concrete)	....	....	2.50	2.62	....
5,300 " " wood (concrete)	3.25	2.85	....	....	....
75 " " brick (sand)	2.75	1.60	2.00	2.00	1.60
100 ft. new curb	.75	.60	.65	.70	.65
2,700 " curb reset	.45	.26	.26	.30	.26
200 " headers	.70	.60	.65	.70	.65
72 " 12" c.-i. pipe	1.50	1.60	1.65	1.80	1.60
1,430 " 10" vitrified pipe	.50	.65	.80	.90	.65
100 sq. yds. flag relaid	.30	.27	.27	.35	.27
5 catch basins	60.00	95.00	100.00	110.00	95.00
5 manholes	50.00	50.00	50.00	55.00	50.00
Totals Bitulithic (concrete)	.....	.....	.....	.....	$16,536
Bitulithic (crushed stone)	.....	.....	.....	.....	$15,900
Brick (concrete)	.....	.....	$17,584	$18,586	.....
Wood (concrete)	$21,204	$18,965	.....	.....	.....

*Awarded contract.

Paving South Main St.—	(A)	(B)	(C)	(D)	(E)	(F)*
3,300 cu. yds. earth excavation	$0.55	$0.63	$0.80	$0.50	$0.75	$0.55
10 " " rock excavation	2.25	1.50	2.50	2.50	2.50	1.50
100 " " rock in trench	3.00	2.25	3.25	3.50	3.00	2.25
25 " " crushed stone	1.90	1.50	2.00	2.08	2.00	.50
14,000 sq. yds. bitulithic (concrete)	....	....	....	2.05	....	2.42
14,000 " " bitulithic (crushed stone)	....	....	....	2.05	....	2.30
14,000 " " brick (concrete)	....	....	2.65	....	2.60	....
14,000 " " wood (concrete)	3.15	2.85	....	....	....	....
50 " " brick (sand)	2.75	1.60	1.80	2.40	1.80	1.60
3,600 ft. new curb	.75	.60	.70	.90	.68	.65
3,000 " curb reset	.45	.22	.30	.35	.30	.26
300 " headers	.70	.60	.70	.90	.68	.65
108 " 12" c.-i. pipe	1.50	1.60	1.65	1.40	1.70	1.60
60 " 16" c.-i. pipe	2.15	2.00	2.25	2.50	2.35	2.00
150 " 8" vitrified pipe	.48	.50	.50	1.00	.55	.50
200 " 15" vitrified pipe	.80	.87	1.05	1.20	1.00	.87
1,250 " 18" vitrified pipe	.95	1.00	1.15	1.50	1.12	1.00
200 sq. yds. flag relaid	.30	.27	.31	.28	.30	.27
15 catch basins	60.00	95.00	110.00	120.00	100.00	95.00
1 manhole	50.00	50.00	40.00	60.00	40.00	50.00
Totals Bitulithic (concrete)	.....	.....	.....	$39,939	.....	$42,663
Bitulithic (crushed stone)	.....	.....	.....	$39,939	.....	$40,983
Brick (concrete)	.....	.....	$47,655	.....	$46,490	.....
Wood (concrete)	$53,403	$48,657	.....	.....	.....	.....

*Awarded contract.

specifications by Chas. T. Main, Engr., Boston, will consist of three 72-in. Bigelow horizontal return tubular boilers, a feed water heater, and an auxiliary heater arranged for connection to a future economizer, 19" × 36" Cooper-Corliss horizontal simple non-condensing engine, direct connected to a 250KW. Crocker-Wheeler alternating current generator. No piping will appear in the engine room, all steam being taken from below the floor. The economizer when installed will heat water for manufacturing purposes, a tank being provided in the dye house and the system so arranged that the water will circulate through the economizer and be stored in the tank.

TRADE PUBLICATIONS.

INDUSTRIAL RAILWAYS.—Ernst Wiener Co., 66 Broad St., New York. Paper; 4 × 9 ins.; pp. 2; illustrated.

This folder contains illustrations and brief descriptions of cars and portable track for industrial railways.

HANDT POWER PUMPS.—The Goulds Mfg. Co., Seneca Falls, N. Y. Paper; 3¾ × 6¼ ins.; pp. 4; illustrated.

This pamphlet contains brief descriptions and price lists of the various force, feed and air pumps illustrated.

STEEL SHEET PILING.—Lackawanna Steel Co., 2 Rector St., New York, N. Y. Paper; 9 × 7 ins.; pp. 6; illustrated.

This pamphlet shows a new section of interlocking steel piling, and gives brief particulars of its use in a large cofferdam in the harbor at Buffalo.

AIR WASHING APPARATUS.—The New York Blower Co., Chicago, Ill. Paper; 6 × 9 ins.; pp. 26; illustrated.

The advantages of air free from dust in buildings, etc., are pointed out and a washing apparatus is described. Pumps for use in connection with this apparatus are also described.

BORING MILLS.—Niles-Bement-Pond Co., 111 Broadway, New York. Paper; 9 × 12 ins.; pp. 46; illustrated.

This catalog contains half-tone illustrations and general descriptions of Niles Boring Mills of from 30-in. to 25-ft. swing. Various attachments for these mills are also described.

FIREPROOF FLOOR SYSTEMS.—Columbia University Fire Testing Station, New York City. Test No. 60. Printed report No. 9. 6 × 9 ins.; pp. 31; illustrated.

This is the report of a regular fire test conducted by Prof. Ira H. Woolson upon a generators. The sizes and capacities of the lines are not given.

HIGH EFFICIENCY ILLUMINANTS.—The Welsbach Co., Gloucester, N. J. Bulletin 14. Paper; 8 × 9½ ins.; pp. 19; illustrated.

Mr. H. M. Daggett, Superintendent of the Welsbach Co., of New England, is the author of this study of the most efficient gas and electric lamp on the market today.

CAR AND TRACK JACKS.—Templeton, Kenly & Co., 18 Sloan St., Chicago. Paper; 3½ × 6 ins.; pp. 32; illustrated.

"Simplex" jacks of from 10 to 35 tons capacity are shown in this pamphlet, and their operation is made clear by sectional views. List prices of jacks and separate parts accompany the illustrations.

COOLING TOWERS.—Edwin Burharn, 71 Wall St., New York City. Paper; 8¼ × 6 ins.; pp. 48; illustrated.

The applications of cooling towers to refrigerating, distilling and ice-making plants, breweries, factories, etc., are outlined. Considerable data on design and operation of cooling towers is also appended.

AUTOGENOUS WELDING.—Industrial Oxygen Co., Hanover Bank Bldg., New York City. Paper; 6 × 9 ins.; pp. 12.

This pamphlet advertises autogenous welding, with acetylene and oxygen, in general and in particular a preparation, known as "oxygenite" which generated oxygen by being "burned" in a proper closed vessel.

CONCRETE REINFORCEMENT. — Oneida Community, Ltd., Oneida, N. Y. 8 × 10 ins.; pp. 4.

The Oneida Community has added to its other industries the manufacture of a certain style of concrete reinforcement known as the "Community Chain Reinforcement," which consisted of double-crossed wires and chains.

AIR WASHERS.—Carrier Air Conditioning Co. of America, Taylor Bldg., Cortlandt St., New York City.

This company, having purchased from the Buffalo Forge Co., all rights for the manufacture and sale of this latter concern's air washing and humidifying apparatus, have issued Catalog No. 92 of the former company.

MACHINE TOOLS.—Pratt & Whitney Co., Hartford, Conn. Paper; 9 × 12 ins.; pp 22; illustrated.

The particular tool described in this catalog is called the "Spline Malling Machine." It is a new tool, doing work for which there has been no adequate machinery before. Its particular field is in milling slots, especially slots with closed ends.

BOX CAR ROOF.—Asbestos Protected Metal Co., Canton, Mass. Catalog No. 48A. 5½ × 7½ ins.; pp. 12; illustrated.

The Robertson standard box car roof, described in this catalog, is described as a durable weather proof, flexible rust and fireproof covering for freight and refrigerator cars. It is an inside roof made entirely of asbestos protected metal.

AIR COMPRESSORS.—Chicago Pneumatic Tool Co., Fisher Bldg., Chicago, Ill. Catalog No. 26. Paper; 6 × 9 ins.; pp. 27; illustrated.

In this catalog are shown the various styles of Franklin air compressors, both steam driven and geared to electric motors. Tables of general specifications and dimensions are given for each style.

SPIRAL RIVETED PIPE.—American Spiral Pipe Works, Box 485, Chicago, Ill. Pamphlet No. 22. Paper; 7¾ × 10 ins.; pp. 16; illustrated.

This pamphlet calls attention to the many uses for which Taylor's spiral riveted pipe is especially adapted. Interesting illustrations are shown of spiral riveted pipe lines in a variety of applications.

REINFORCED-CONCRETE BUILDINGS.—The Turner Construction Co., 11 Broadway, New York City. Bulletin No. 4. 9 × 11 ins.; pp. 8; illustrated.

The current number of this monthly bulletin is a description of a large reinforced-concrete warehouse recently built by the Turner Construction Co. for the Great Atlantic & Pacific Tea Co., at Jersey City, N. J.

ROOFING, SIDING, ETC.—Asbestos Protected Metal Co., Canton, Mass. Catalog No. 4. 5 × 7½ ins.; pp. 29; illustrated.

The basic component parts of the material which this company makes and which is described in this catalog are sheet steel, pure asphalt and asbestos. It is made and sold in sheets the same as sheet metal.

POWER TRANSMISSION APPARATUS.—T. B. Wood's Sons Co., Chambersburg, Pa. Catalog 24. Paper; 6 × 9 ins.; pp. 62; illustrated.

This catalog contains, in condensed form, matter on a complete line of apparatus for the mechanical transmission of power. This line includes shafting, couplings, shaft hangers and bearings, pulleys, clutches, etc.

STEAM SUPERHEATERS.—Heine Safety Boiler Co., St. Louis, Mo. Paper; 6 × 9 ins.; pp. 12; illustrated.

"Superheater Logic" is the title given this pamphlet, which sets forth the requirements of location, care, etc., for successful operation of superheaters. The Heine superheater attachment for use with the regular Heine water-tube boiler is described and pictured.

WATERPROOF CEMENT.—Texas Cement Waterproofing Co., 31 Jefferson St., Dallas, Texas. 3½ × 6 ins.; pp. 4.

This company is making for commercial use a waterproofing compound known as "Nonab," which, it is claimed, will render a concrete waterproof at the same time not diminishing its strength. It comes as a powder to be mixed dry with the cement and aggregate.

LOCOMOTIVES. — Vulcan Iron Works, Wilkes-Barre, Pa. Data Leaflets. Paper; 6 × 9 ins.; pp. 52; illustrated.

The 13 leaflets, forming this series of data sheets, give the characteristics and principal dimensions of several types of light locomotives. The pages are gotten up in attractive style and are well worth filing by all who have need of employing any of the lighter locomotives.

REINFORCED-CONCRETE FACTORY BUILDINGS.—"The Modern Loft and Factory Building and How to Build." By Oswin W. Shelly, 156 Fifth Ave., New York City. 7½ × 9 ins.; pp. 47; illustrated.

This is a very well illustrated description of a number of reinforced-concrete buildings recently erected by Mr. Shelly, under a form of contract, which he recommends in his opening pages.

FOUNDRY EQUIPMENT.—Whiting Foundry Equipment Co., Harvey, Ill. Catalogs Nos. 43-55. Paper, with cloth binder; 6 × 9 ins.; pp. 243 (total); illustrated.

In this combined catalog are many excellent illustrations showing electric and hand power cranes, pneumatic hoists, cupolas, crane ladles and other foundry equipment. The Whiting cupola is described in detail with sectional views and a diagram showing general dimensions.

MINING MACHINERY.—Power & Mining Machinery Co., Cudahy (Suburb of Milwaukee), Wis. Bulletins Nos. 27 and 28. Paper; 6 × 9 ins.; pp. 16 and 20; illustrated.

These bulletins describe respectively Huntington improved mills and superior rolls. Besides the half-tone illustrations, there are drawings showing the general dimensions of the machines. The improvements made on the Huntington mill are described in detail.

For other Proposal Advertisements see pages 43, 44, 45, 46, 49, of Advertisements and Construction News page 98.

TRANSFORMER STATION EQUIPMENT.

Toronto, Ont.

Tenders will be received until 6 p. m., Monday, 28th September, 1908 (a) For the supply and erection of 63,500 Volt, Single Phase, or 110,000 Volt, Three Phase Transformers for operation on the Commission's 110,000 Volt Transmission System; (b) For the manufacture, supply and erection complete of the Switching and Indicating Apparatus for the 110,000 Volt Transformer Stations. Apparatus is required for the following high tension transformer stations: Niagara Falls Step-up Transformer Station, Toronto, London, Dundas, Guelph, Preston, Berlin, Stratford, St. Marys, Woodstock, Brantford and St. Thomas Step-down Transformer Stations; all according to plans and specifications to be obtained at the Commission's Office, Continental Life Building, Toronto. Accepted cheques on chartered banks for amounts specified in "Instructions to Bidders" must accompany each Tender for the work. These cheques will be fortified providing the Tenderer declines to enter into a Contract after due notice by the Commission.

The lowest or any Tender not necessarily accepted.

Tenders must be sealed and addressed:

HON. ADAM BECK,
Chairman Hydro-Electric Power Commission of Ontario, Toronto, Ont.

Newspapers inserting this advertisement without authority from the Commissioner will not be paid for it.

SANITARY SEWERS.

Hope, Ark.

Sealed bids will be received until Oct. 6th, 1908, by the Board of Sewer Commissioners, Improvement District No. One, for furnishing all materials for and installing a system of Sanitary Sewers in the Town of Hope, Hempstead County, Arkansas.

All bids must be enclosed in sealed envelope, addressed to the Secretary of the Board, and endorsed "Sewer Bid."

All bids must be accompanied by a certified check in the sum of $1,200.00, payable to the Secretary of the Board. The checks will be promptly returned to unsuccessful bidders, and to successful bidders when bond is made.

The system comprises about 102,000 feet of vitrified sewers from 6-inch to 15 inches in diameter, a disposal works, manholes, flush tanks, etc.

The right is reserved to reject any or all bids.

Plans and Specifications are on file at the office of the Secretary of the Board at Hope, Arkansas, and at the office of the Engineer, J. A. Omberg, Jr. Goodwyn Building, Memphis, Tenn.

E. S. GREENING, JR.,
Secretary.

WATER-WORKS.

Hope, Ark.

Sealed bids will be received until Oct. 6, 1908, by the Board of Water-Works Improvement District No. One, for furnishing all materials and installing a system of water-works in the Town of Hope, Hempstead, Arkansas.

All bids must be enclosed in sealed envelope addressed to the Secretary of the Board, and endorsed "Water Works Bid."

All bids must be accompanied by a certified check payable to the Secretary of the Board, in the sum of $350.00, for each of the items (a), (b), (c) and (d) bid on. The checks will be promptly returned to unsuccessful bidders and to successful bidders after bond is made.

Included in the installation there will be (1) A surface reservoir about 70 × 35 × 12 feet of reinforced concrete; (2) about 900 tons of cast-iron pipe, together with hydrants, valves, laying, etc.

The right is reserved to reject any or all bids.

Plans and specifications are on file at the office of the Secretary of the Board, and at the office of the Engineers, J. A. Omberg, Jr., Goodwyn Building, Memphis, Tenn.

E. S. GREENING, JR., Secy.

WATER-WORKS.

Passaic, N. J.

By direction of the City Council of the City of Passaic, New Jersey, proposals are hereby invited for:

First: Distributing, laying [illegible] about thirty-seven (37) miles of six inch to twenty (20) inch pipes, hydrants, gate valves, specials, etc.

Second: Furnishing and delivering the said pipes, hydrants, gate valves, specials, etc.

Third: Furnishing a new water supply from three (3) million gallons per day up to twelve (12) million gallons per day, to be taken from wells or surface streams.

All proposals must be in conformity with the forms of proposal and specifications adopted by the Committee on Water Supply of which printed copies may be obtained at the office of the City Clerk or the City Surveyor of said City.

The City reserves the right to reject any and all proposals. All proposals must be submitted in a sealed envelope addressed to the Committee on Water Supply, care of the City Clerk, on or before the thirtieth day of October, 1908, at 8 o'clock P. M.

A certified check for one thousand dollars to the order of the City Treasurer of the City of Passaic, N. J., must accompany each bid, to be forfeited to the City if the bidder in the event his proposal is accepted, shall not within ten days thereafter enter into proper contract for carrying out his proposal.

GEORGE K. ROSE,
JOSEPH SPITZ,
HERMAN FRIEND,
Committee on Water Supply of the City Council of the City of Passaic, N. J.

WATER PIPE.

Newark, N. J., Sept. 9, 1908.

Sealed proposals will be received between 3.15 and 3.30 o'clock p. m., and opened at the last named hour, Tuesday, Sept. 17, 1908, at a public meeting of the Board of Street and Water Commissioners, City Hall, Newark, N. J., for the following coated cast-iron water pipe and special castings:

90 short tons of 8-inch special hub pipe.
35 short tons of 12-inch special hub pipe.
1,100 short tons of 16-inch special hub pipe.
80 short tons of 20-inch special hub pipe.
30,000 lbs. specials to order without wrought iron bands on hubs.
70,000 lbs. specials to order with wrought iron bands on hubs.

All f. o. b. cars Newark, N. J., according to the specifications, which will be furnished upon application to the undersigned.

Proposals must be accompanied by the consent in writing of two sureties, residents of Essex County, N. J., or a surety company authorized to do business in the State of New Jersey, who qualify as to their responsibility in the amount of the proposal and agree to become sureties for the faithful performance of the contract, if awarded.

By direction of the Board.

MORRIS R. SHERRERD,
Chief Engineer.

OFFICE, COMMISSIONERS, District of Columbia, September 8, 1908.—Sealed proposals will be received at this office until 12 o'clock noon, September 28th, 1908, for reconstructing portions of the Rock Creek and B Street Intercepting Sewer, between M and O Streets, District of Columbia. Forms of proposals, specifications, and necessary information may be obtained from Chief Clerk, Engineer Department, Room 427 District Building, Washington, D. C. HENRY B. F. MACFARLAND, EDWARD M. MARKHAM (Acting), Commissioners, D. C.

OFFICE CONSTRUCTING QUARTERMASTER, Fort Wood, N. Y. H., Sept. 8, 1908.—Sealed proposals, in triplicate, for sodding and repairing terraces at this post will be received here until 10.45 a. m., October 1, 1908, and then opened. Information furnished on application. The U. S. reserves the right to reject any or all bids or any part thereof. Envelopes containing proposals should be marked "Proposals for Sodding and Repairing Terraces" and be addressed to WM. W. BESSELL, Constg. Qr. Mr.

Situations Wanted

AMERICAN, 21 years old, desires position with civil engineer or surveyor; small salary. Address "F. A. 11," Engineering News, New York. 11-2t